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E. J. Warwick.

U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

ANIMAL AND POULTRY HUSBANDRY RESEARCH BRANCH

and

COOPERATING WESTERN STATES

W-1 - IMPROVEMENT OF BEEF CATTLE THROUGH THE APPLICATION OF BREEDING METHODS

1956 Annual Report of W-1

and

Report of

Annual Meeting of Technical Committee

Davis, California

July 19 - 21, 1956

This report is intended for the use of administrative leaders and workers and is NOT for general publication.

To Dr. William Ernest Castle

Who, for more than fifty years as teacher and scientist has contributed so significantly to the development of mammalian genetics, the W-1 Technical Committee dedicate their 1956 Annual Report.

ANNUAL MEETING
W-1 Technical Committee
Davis, California
July 19 - 21, 1956

F. S. Willson, Chairman

Members Present:

Arizona	C. B. Roubicek
California	P. W. Gregory
Colorado	H. H. Stonaker
Hawaii	Oliver Wayman
Idaho	R. E. Christian
Montana	F. S. Willson
Nevada	J. F. Kidwell
New Mexico	R. L. Blackwell
Oregon	Ralph Bogart
U. S. Range Livestock Experiment Station, Miles City, Montana	J. R. Quesenberry
Utah	J. A. Bennett
Washington	S. H. Fowler
Wyoming	P. O. Stratton
Regional Administrative Adviser	S. S. Wheeler
Western Region - Coordinator's Office	C. E. Shelby
Agricultural Research Service:	
Animal and Poultry Husbandry Research Branch	E. J. Warwick
State Experiment Stations Division	W. E. Shaklee

Dr. C. F. Sierk, Chairman of the W-1 Technical Committee for 1955-56, resigned his position as Head of the Department of Animal Husbandry at the University of Idaho effective February 1, 1956, to accept a position as Assistant Chief, Livestock Products and Poultry Branch, Office of Food and Agriculture, International Cooperation Administration. Mr. F. S. Willson, Technical Committeeman from Montana, next state in alphabetical order, was appointed by the Executive Committee to the Chairmanship of the Committee for the remainder of the year.

The meeting was called to order at 8:00 A.M., by Mr. F. S. Willson, who introduced the new members. Dr. R. E. Christian succeeds Dr. Sierk as Technical Committeeman from Idaho, and Dr. S. H. Fowler is serving as the Committeeman from Washington following Dr. Galgan's transfer to sheep work.

Mr. Willson also greeted the Extension Specialists, the Coordinators from the North Central and Southern regions, and other visitors.

Dr. Gregory announced that tours had been planned for the Extension people for the afternoons when the Technical Committee would be in business session. Dr. Meyer would cover forage and pasture work. The California dairy herd is one of the oldest experimental breeding herds in the country. Dr. Laben would review that breeding work, and Dr. Cassard would explain the sheep breeding experiment.

The reports from the states followed.

University of Arizona

I. Station: Arizona Agricultural Experiment Station, Tucson, Arizona.

II. Project Title: Breeding and selection of beef cattle for the Southwest.

III. Personnel:

A. Experiment station personnel:
1. C. B. Roubicek
2. O. F. Pahnish
3. E. B. Stanley
4. R. M. Richard

B. Cooperators:
1. Frank Boice, Jr. (Empire Ranch) Sonoita, Arizona.
2. Henry Boice (Arivaca Ranch) Arivaca, Arizona.

C. Cooperators (U. S. Department of Agriculture):
1. R. T. Clark, Coordinator.
2. U. S. Range Livestock Experiment Station, Miles City, Montana.
3. Apache Indian Agency and Tribe, San Carlos, Arizona.

IV. Nature and Extent of Work Done This Year: The accumulation of performance data from the Boice Ranches at Sonoita and Arivaca has continued as outlined in the Arizona project. Six years of data have been processed through IBM and are now being analyzed.

Ten separate breeding pastures have been completed at the purebred headquarters of the Apache Indian Agency, San Carlos. Three hundred registered females were randomly assigned to these breeding pastures. Six bulls from Miles City and four bulls from the Indian Agency will be used. Weight and grade data will be obtained on all progeny at birth and every six months for two years.

A bull from the New Mexico Station was bred to 18 proven dwarf-carrier cows at the Arizona Station. The cows were selected for this test herd because they produced a typical "snorter" dwarf calf. The cows have just started calving, and final results will not be available until July. However, the second calf born was a definite lethal. It was a full term calf, but weighed only 31 pounds at birth. The long bones are shortened, but the head is not an extreme dwarf type. A long-headed Hereford dwarf heifer bred by a short-headed dwarf Hereford bull produced a calf which was not a typical dwarf.

V. Summary of Progress and Conclusions to Date: A preliminary study of the data from the Boice herds indicates that selection for conformation at weaning has been very successful in practically eliminating any extreme variation in conformation. In our scoring system, 15 is the top score with 12 a top choice animal. All calves at last weaning scored 11, 12, or 13. The corrected weaning weights of the bull calves showed a low weight of 362 pounds and a high of 611 pounds. The heifer calves ranged from 325 to 513 pounds. Although the average weaning weights have shown an increase during the past few years, it would appear that a great deal more progress can be made by emphasizing this characteristic in selection of all replacement animals.

VI. Work Planned for the Future: The work with the Boice herds will continue. Weight data on yearling heifers indicate that there are marked differences in the wintering ability of these animals. Some individuals show a weight gain during this period while others show a 15 to 20 percent weight loss. A further study of these data, together with information from the Apache herd, will be undertaken to determine if additional emphasis should be placed on this characteristic for replacement selection.

We plan to use the same sires next year in the Apache herd that were used this year.

Progeny testing of sires from the New Mexico Station on the dwarf-carrier herd will be continued. It is anticipated that information will be obtained which will show the genetic relationship of the lethal condition present in the New Mexico herd to the dwarf gene present in the carrier herd.

The meats laboratory will be completed in 1956. This will enable us to include meat and carcass studies in the W-1 project.

VII. Publications and Manuscripts:

Pahnish, O. F., E. B. Stanley, and C. E. Safley. 1955. Breeding history of an experimental herd of dwarf beef cattle. J. Anim. Sci. 14:1025-1033.

_____, E. B. Stanley, C. E. Safley, and C. B. Roubicek. 1955. Dwarfism in Beef cattle: The description, cause, and control. Ariz. Agr. Expt. Sta. B. 268.

Roubicek, C. B. 1955. Two blades of grass. Ariz. Cattlelog 11:25-27.

A literature review of Range Cattle Production is in press. This review includes the following sections:

RANGE CATTLE PRODUCTION

I. Reproduction
C. B. Roubicek, R. T. Clark, P. O. Stratton

II. Pre-natal development
C. B. Roubicek, R. T. Clark, P. O. Stratton, O. F. Pahnish

III. Birth to weaning
C. B. Roubicek, R. T. Clark, O. F. Pahnish

IV. Post-weaning performance
C. B. Roubicek, R. T. Clark, R. M. Richard, O. F. Pahnish

V. Carcass and meat studies
C. B. Roubicek, R. T. Clark, O. F. Pahnish

VI. Maternal factors
C. B. Roubicek, R. T. Clark, R. M. Richard, O. F. Pahnish

VII. Inheritance
C. B. Roubicek, R. T. Clark, O. F. Pahnish

VIII. Effects of climatic environment
C. B. Roubicek, R. T. Clark, O. F. Pahnish

PROJECT SUMMARY
Fiscal Year 1956

a. Cattle Inventory
(1) Purebreds

State Arizona
Date 6/1/56

Line designation	Arivaca	Empire	San Carlos
Breed	Hereford	Hereford	Hereford
Station	Arizona	Arizona	Arizona
Bulls (12 mo. or over)	27	27	78
Cows (2 yrs. or over)	78	68	334
Heifers, yearlings	23	28	62
Bull calves	24	22	
Heifer calves	30	31	
Percentage use for breeding project			
Estimated cash value	$22,480	$19,200	$78,600

(2) Grades

Line designation	Heterozygous	Dwarf	
Breed	Hereford	Hereford	
Station	Arizona	Arizona	
Bulls (12 mo. or over)		1	
Cows (2 yrs. or over)	18	2	
Male calves		4	
Heifer calves		7	
Percentage use for breeding project	100	100	
Estimated cash value	1,440	500	

d. Cow production data 1955 calves.

Breed	Hereford	Hereford
Line	Arivaca	Empire
No. cows bred	64	59
No. calves born		
(a) alive	54	53
(b) dead	2	1
(c) total	56	54
No. calves weaned	54	50
Percent calf crop		
(a) birth	87.5	91.5
(b) weaning	84.4	84.7

	Bulls		Heifers		Bulls		Heifers	
Average:	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
1. Weaning age		255		258		266		264
2. Weaning weight	24	440	30	406	21	490	31	424
3. Weaning weight								
(adj. 270 days)		466		419		497		435
4. Weaning score								
(a) Condition	24	12.02	30	12.17	21	11.67	31	11.78
(b) Conformation	24	12.15	30	11.86	21	11.72	31	12.38

e. Feed lot performance - Individually fed bulls 1955

Breed	Hereford	Hereford
Line	Arivaca	Empire
Sex	Bulls	Bulls
No. on test	6	6
Average: Age on test	308	320
Initial weight	600	640
Initial score		
(a) Condition	12.0	12.0
(b) Conformation	12.5	12.0
Days on test	196	196
Gain		
(a) Total	559	550
(b) Average	2.85	2.81
Efficiency of feed utilization (a) Lb. feed/100 lb. gain	1129	1216
Final weight	1160	1190
Final score		
(a) Condition	15	15
(b) Conformation	13	12

University of California

I. Station: California Agricultural Experiment Station, Davis, California.

II. Project Title: Genetic control of hereditary deficiencies in beef cattle with special emphasis upon dwarfism (Project 1451).

III. Personnel: P. W. Gregory, F. D. Carroll, G. P. Lofgreen, L. M. Julian, W. S. Tyler, L. W. Holm, T. J. Hage, C. E. Cornelius, Dorothy S. Sprague, Lucy Kravetsky, Carlos Roe Young, and R. T. Clark, Coordinator.

IV. and V. Nature and Extent of Work Done This Year and Summary of Progress and Conclusions to Date:

All of the research was concerned with specific biological disciplines such as genetics, cytochemistry and cytology, biochemistry and physiology, and anatomy and radiology, upon the problem of dwarfism. Even though the aim was for completeness of integration of research within each discipline, the over-all design was to attempt to integrate as far as possible the researches of all the disciplines. Just how far it may be possible to carry this over-all integration is yet to be determined, but the results to date are encouraging.

A. GENETICS

During the past six years many different morphological forms of dwarfs from Hereford, Angus, and Shorthorn breeds, and normal Hereford cows that have produced dwarfs have been assembled at the California Station for critical genetic analysis. The results of tests from these matings may be summarized as follows:

1. Several critical mating tests have been made. In all cases, the number of test progeny was limited to proving a specific animal or type at approximately the one percent level. Some of the tests are outstandingly significant, others are not, but indicate a definite trend which should become significant when an adequate number of test progeny is produced. Proven heterozygous cows of normal size mated to proven heterozygous bulls of normal size and bulls that profile as carriers produced only calves that were classified as normal. The expected number of dwarf calves was 3.75. After these calves reached 30 months of age it became apparent that 4 were subnormal in size and that they resembled compact animals in size and general conformation. The original compact animals are alleged to be descendants of Colorado Domino 68. The compact-like segregates in our herd were not descended from Colorado Domino 68 and are tentatively regarded as "recurrent compact." More "recurrent compact" have been produced from the heterozygous cows mated to bulls that profile in the overlap zone. Animals classified as "recurrent compact" type are now being progeny tested and even though the results are not statistically significant to date they have yielded a much higher percentage of dwarf calves than heterozygous cows of normal size mated to proven dwarf-carrier bulls or unproven bulls of normal size that profile as carriers.

A check of registered herds in the field indicates that there is an appreciable number of animals that meets the size and conformation specification of the "recurrent comprest" that segregates from the mating of normal animals that are proven to be heterozygous for the dwarf gene. These "recurrent comprest" animals seem to produce an inordinately high proportion of dwarf calves under our laboratory conditions and in the field.

2. A privately owned registered herd composed of 60 comprest cows mated to 3 bulls all proven by progeny test to be carriers of the dwarf gene has been under intensive study. The 1955 calf crop provided some important data. The complete 1956 calf crop was studied in detail. Radiographs of the skull, lumbar region, and metacarpals along with photographs were obtained on each calf. The whole cow herd was classified as to type, body weights were obtained, and each cow was photographed behind a screen which permits estimation of certain linear body dimensions. Radiographs of a critical body part were also obtained on the comprest cows. The calves produced by these cows fall into several distinct types. Some are of normal size, some are comprest type, some are short-headed dwarfs (snorter), and some are longheaded dwarfs. All dwarfs were brought to Davis for special study. The short-headed dwarfs manifested all the diagnostic features characteristic of the short-headed (snorter) dwarf produced from heterozygous animals of normal size and could not be differentiated from them by the diagnostic means at our disposal.

3. Matings of short-headed (snorter) dwarfs with long-headed dwarfs within the Angus breed, within the Hereford breed, and between breeds produced two types of progeny, 14 comprest-like animals in size and conformation, and 2 short-headed dwarfs. This reversion to a comprest-like type is genetically and statistically significant. Comprest-like animals produced in this manner are called "synthetic comprest." These "synthetic comprest" are being progeny tested by backcrossing to both parental types. The results clearly indicate that the size of the dam has little, if any, effect on the classification of the progeny. When "recurrent comprest" is backcrossed to the short-headed dwarf parent, the total progeny produced to date is 12 short-headed dwarfs and 3 "recurrent comprest." When "recurrent comprest" was backcrossed to the long-headed dwarf parent, the progeny observed were 3 short-headed dwarfs, 1 long-headed dwarf, and 3 "recurrent comprest."

4. Daughters of heterozygous cows of normal size sired by heterozygous bulls of normal size were mated to a dwarfish Shorthorn bull presumed to be of the "compact" type studied by Stonaker & Tom (1944). This mating produced 8 progeny which were classified as follows: 2 short-headed dwarfs, 1 long-headed dwarf, 1 a definite dwarf but unclassified as to type, and the remaining 4 are as yet unclassified but are alive and will be classified eventually. This test clearly indicates that the "compact" Shorthorn bull is a part of the dwarf complex. The results reported in 1, 2, and 3 above also indicate short-headed (snorter) dwarfs, long-headed dwarfs, comprest, "recurrent comprest" and "synthetic comprest" are each components of the same genetic dwarf complex.

5. Short-headed dwarfs are falling into 4 morphological types with sufficient frequency to suggest that they may represent specific subtypes.

a. Short-headed dwarf with broad, bulging forehead and a relatively narrow muzzle. This is the most common type.

b. Short-headed dwarf with a broad, bulging forehead and a relatively broad muzzle. Three of these segregated from our experimental matings and all were stillborn. The fourth came from the field and it was stillborn. This type is relatively rare or else tends to be less viable and is less likely to be obtained from the field.

c. Short-headed dwarf with broad, bulging forehead and a relatively narrow muzzle, and crooked forelegs. This type has been observed in dwarfs of comprest breeding, or recurrent comprest stocks.

d. Short-headed dwarf with broad, extremely bulging forehead caused by a marked hydrocephalus condition. The muzzle tends to be narrow. The cases observed to date are stillborn, or live only a few hours.

These four types segregate from related stock and are assumed to be variants of the same major dwarf conditioning gene. All four types have one feature in common--a premature fusion of the sphenoid and occipital bones.

When the results of all the dwarf segregates from crosses involving different dwarf types and test matings are considered, it is obvious that in addition to a major autosomal dwarf-conditioning gene which conditions dwarfism there are also modifying genes which influence the expression of the major autosomal recessive dwarf-conditioning gene. These dwarf modifiers appear to act upon the major recessive dwarf-conditioning gene to specifically differentiate dwarf types. The exact number of dwarf types involved is yet to be determined, but there may be as many as a dozen. There is evidence that two of the modifiers interact with the major dwarf-conditioning gene in the homozygous state to affect genetic homeostasis. All the comprest type appear to fall into this category. Thus homozygous dwarfs carrying specific modifiers or modifying complexes may actually be classified as phenotypically normal animals.

Since several different morphological forms of dwarfism are involved in the dwarf complex and only the short-headed (snorter) dwarf is generally recognized, progeny testing will prove disappointing or ineffective until all the different forms of the dwarf complex are recognized. Our studies indicate that because of dwarf modifiers, heterozygous tester cows are far less effective for proving bulls than dwarf cows. When it is possible to recognize all the different types of dwarfs that compose the dwarf complex, heterozygous tester cows will prove efficacious for testing bulls.

6. Until all the different dwarf forms that are components of this genetic complex can be recognized, it will be difficult if not impossible to determine the efficacy of the profilometer, radiographs, or any other method for differentiating between dwarf-carrier and dwarf-free animals.

B. CYTOCHEMISTRY AND CYTOLOGY

Considerable attention has been devoted to certain cytochemical and cytological aspects of the bovine dwarf complex. These studies were in collaboration with Professor C. Leuchtenberger of the Institute of Pathology of the Western Reserve University and Professor Franz Schrader of the Department of Zoology of Columbia University. The Desoxyribose Nuclei Acid (DNA) content was studied in cells of dwarfs of the short-headed type, heterozygotes based upon head profile, and homozygous normal based upon progeny tests or head profile. Standard methods were used for estimating the DNA content in somatic and testicular tissue. The DNA values are more variable in dwarfs, but the DNA value per nucleus in spermatogenic cells is markedly deficient when compared with corresponding cells of bulls of normal phenotype. Other relationships were studied. These bovine dwarfs have one thing in common with the dwarf mouse described by Snell (1929) in that both are deficient in DNA, Leuchtenberger, Helweg-Larsen, and Murmanis (1954).

A study of chromosome counts in normal and dwarf bulls indicated that the dwarfs have a normal complement of chromosomes.

C. CHEMICAL AND HEMATOLOGICAL STUDIES

Considerable attention has been devoted to chemical and hematological studies of the blood of dwarfs. The results may be summarized as follows:

1. Serum proteins, calcium, magnesium, and phosphorus of "short-headed" bovine dwarfs are all within normal limits.

2. Serum cholesterol and protein-bound iodine levels are within the normal range and indicate that the "short-headed" bovine dwarf is not a primary thyroid cretin.

3. All hematological values appear normal except for the differential count.

D. BIOCHEMISTRY AND PHYSIOLOGY

Insulin-glucose tolerance curves have been determined on normal animals and on short-headed dwarfs. The tolerance test used by Heidenreich, Lasley, and Comfort (J.An.Sci.14(4):1184, 1955) to differentiate the physiological responses of dwarf and normal animals to severe stress proved to be of no value when applied to calves beyond the suckling stage. In suckling calves, however, preliminary data indicate that the dwarf animal cannot handle injected glucose as well as the normal animal of the same age. Although these data tend to confirm those of Heidenreich, et al, too few animals have been tested to allow a definitive statement to be made.

E. ANATOMY AND RADIOLOGY

As stated in section A, a number of types of bovine dwarfs exists. These are identifiable by factors of appearance, factors which are morphological. As also stated in section A, efficiency of control measures will depend upon recognition of all dwarf types. The anatomy research program is following these aims by a systematic study of the morphological characteristics of each of the dwarf types and of phenotypically normal animals. Studies during the past year have concentrated upon the short-headed dwarf since this animal apparently represents the most extreme of the dwarf varieties. Once its identifying characteristics have been described, each will be sought in the other varieties of dwarfs. It is hoped that the exact influence of the major dwarf conditioning gene and the interaction of that gene and modifying genes may be followed by their specific morphological manifestations. Already there is evidence that these studies will lead to a better understanding of basic growth processes, especially as applied to the domestic bovine. During the past year the skeleton has received the greatest attention; however, data continue to be collected in a systematic fashion on other systems of the body.

1. The short-headed dwarf is identified by detection of a combination of some or all of the following factors: a. an excessively bulging forehead; b. prognathia; c. an overly mature appearance, particularly in younger animals; d. abnormal placement of the head on the neck, and, e. a diminution of size.

a. The persistent bulge in the forehead is due to a disparity of brain size and body size and is enhanced by a tendency toward varying degrees of internal hydrocephalus. An analysis of these factors is to be published in the near future. A method has been devised for quantifying the degree of hydrocephalus exhibited by an individual animal.

b. Evidence suggests prognathia to be due to a specific face-shortening factor. It has been found that the mandibles of dwarfs exhibit normal proportions and that mandibular growth is proportional to total body growth. The face-shortening aspect may be related to a growth deficiency centering in the base of the skull (see 1-d and 2 below).

c. Overly mature appearance is a transitory phenomenon. It involves conformation, the relation of skeleton and muscle dimensions. Dwarfs of one year of age have skeletal muscles which are subnormal in size. The muscular systems of younger animals are now under study.

d. The unusual carriage of the head upon the neck evident in older dwarfs is due to premature fusion of the spheno-occipital junction (see 2 below).

e. The birth weights of most dwarfs are within twenty percent of normal; however, by the second year they are but 50 percent of normal body weight. Although near normal at birth, it will be seen in 2 below that certain skeletal changes are present that clearly distinguish the dwarf from phenotypically normal animals.

2. Premature fusion of the junction between the sphenoid and occipital bones has been detected in short-headed dwarfs in both Hereford and Angus breeds. The normal time of fusion of this joint is between the 24th and 36th month. Partial closure of this synchondrosis has been detected in dwarfs as early as the first day of life. Closure is completed in dwarfs by 5.5 months. Detection of this alteration is possible by roentgenological means.

There is evidence that an intermediate group of phenotypically normal animals exists in which closure commences at about one year of age. The indications are that these animals are a part of the dwarf complex. The relations of early fusion in this group of animals to the dwarf complex and to ultimate somatic development will be studied.

3. A systematic dimensional study of the appendicular skeleton reveals:

a. Times of closure of the various appendicular epiphyses of short-headed dwarfs appear to be normal.

b. The metacarpus reveals the greatest alterations due to dwarfism.

c. These alterations are most evident in young animals.

d. These alterations may be detected by radiological examination of the bone in question.

e. It is suggested that an evaluation of the dimensions of the metacarpal bones of a young animal may prove a valuable means of estimating final growth performance of the animal.

4. Dimensional studies of long bones and the detection of premature fusion of the spheno-occipital synchondrosis, long considered pathognomonic for achondroplasia, indicate that the basic dwarfing processes which are responsible for the short-headed dwarf are achondroplastic in nature.

VI. Work Planned for the Future: The work plans of the future will be continuation or expansion of the research in genetics, anatomy and radiology, biochemistry, physiology, and cytochemistry that has been under way. Much emphasis will be placed upon progeny tests and the genetic relationships of the different forms of the bovine dwarf complex. Special attention will be directed to differential diagnosis of the various dwarf forms by the use of anatomical lesions. Special attention will also be directed toward the recognition of heterozygotes.

VII. Publications and Manuscripts:

Cornelius, C. E., W. S. Tyler, and P. W. Gregory. 1956. Chemical and hematological studies on blood of bovine dwarfs. Soc. Expt. Biol. and Med. Proc. (In press).

Gregory, P. W. 1955. The genetic relationships of phenotypically different bovine dwarfs. (Abs.) J. Anim. Sci. 14:1182-1183.

_____ and F. D. Carroll. 1956. Evidence for the same dwarf gene in Hereford, Aberdeen-Angus, and certain other breeds. J. Hered. (In press).

Julian, L. M., W. S. Tyler, T. J. Hage, and P. W. Gregory. 1956. Premature closure of the spheno-occipital synchondrosis in horned Hereford dwarfs of the "shortheaded" type. (Ms. completed).

Leuchtenberger, Cecilie, Franz Schrader, Sally Hughes-Schrader, and P. W. Gregory. 1956. Certain cytochemical and cytological aspects of dwarfism in cattle. (In press).

PROJECT SUMMARY
Fiscal Year 1956

a. Cattle Inventory

State California
Date May 1956

	Cows	Bulls
Heterozygous	17	
Comprest	10	
Recurrent Comprest	18	2
Synthetic Comprest	6	4
Short-headed dwarfs over 3 yrs. of age	16	2
Long-headed Dwarfs over 2 yrs. of age	18	5
Long-headed Dwarfs Yearlings	2	1
Miscellaneous Dwarfs	8	1
	4	3

I. Station: California Agricultural Experiment Station, Davis, California.

II. Project Title: Breeding experiments with beef cattle (Project 1216).

III. Personnel: W. C. Rollins, F. D. Carroll, N. R. Ittner, K. A. Wagnon, Van Brimhall, R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year:

Davis

Testing bulls directly and by use of progeny for rate of gain, efficiency of gain, and earliness of maturity

This experiment is continuing according to the plan outlined in the W-1 report of two years ago.

Currently, 10 bulls are being individually fed; 8 bulls are out in cooperator herds producing progeny test steers, and 36 head of steers are being fed at Davis in the progeny testing of 4 bulls.

The antipyrene method of estimating degree of fatness is being used on our bulls currently on feed. When our progeny test steers go to market this June, a dozen or more will be tested with antipyrene and then the percent of fat in the carcass will be estimated by the specific gravity method for one side of the carcass. This is to serve as a check on the accuracy of the technique of applying the antipyrene method.

Percentage of fat in the carcass will be estimated for all of the progeny test steers on the basis of the specific gravity of the whole side.

Line Cross

In July 1955, plans were made for reciprocal line crosses between the California station Rover line and the Colorado station Brae Arden line. Both of these are inbred lines. The Brae Arden line is somewhat unique in that it does not trace back to Prince Domino. On the basis of performance this is one of the best of the 16 Colorado inbred lines. No dwarfs have been produced in this line.

INBREEDING AND RELATIONSHIP IN THE ROVER LINE AT PRESENT

Age	Cow Herd Number of Cows	Average Inbreeding
3 years and up	33	8 percent
Less than 3 years	34	15 percent
	67	12 percent

Average genetic covariance* of cow herd with Rover = .50

With 2 out of 67 less than .125
" 4 " " 67 " " .25
" 17 " " 67 " " .50

* Genetic covariance in this case is essentially equal to relationship.

The history and present status of the Colorado Brae Arden line are contained in the Colorado Report, Breeding for Hybrid Vigor, 1955 Progress Report on the Colorado A. & M. Beef Breeding Program, General Series Paper No. 613.

Crosses

At Davis, 3-1-56 to 5-15-56, bull 263 of the California Rover line is being mated to: (1) 30 cows with average inbreeding of 6 percent and with 43 percent average relationship to Rover. The average inbreeding of the resulting calves will be 12 percent, and their average relationship to Rover will be 39 percent.

Bull 4010 of the Colorado Brae Arden line is being mated to: (2) 30 cows with average inbreeding of 17 percent and with average relationship to Rover of 57 percent.

Crosses (1) and (2) will compare a line cross of inbred lines with one of the lines entering the cross.

The Colorado breeding season starts in June and it had been planned to use the same bulls, Rover bull 263 and Brae Arden bull 4010, at Fort Lewis as follows:

Rover bull 263 to be mated to:

1. Colorado line cross cows unrelated to the Rover or Brae Arden lines

2. Brae Arden inbred cows

Brae Arden bull 4010 will be mated to cows of the same breeding as the above two groups.

Cross 1 will compare the general combining ability of the Rover and Brae Arden lines.

Cross 2 will compare a cross of the Rover line and the Brae Arden line with the Brae Arden inbred line.

During the breeding season an outbreak of vaginitis was discovered in the Davis herd. What little is known of the disease is described by Kendrick et al. in the Journal of the American Veterinary Medical Association, Volume 128, Number 7, April 1, 1956, pages 357-361.

As a result, Rover bull 263 will not be shipped to Colorado and it is possible that Brae Arden bull 4010 will not be used there this season. He is being tested with respect to this infection.

A standby bull of the Rover line, bull 310, was shipped to Colorado last fall and will be used in place of bull 263. Bull 310 is 16 percent inbred, 54 percent related to Rover, and 22 percent related to bull 263.

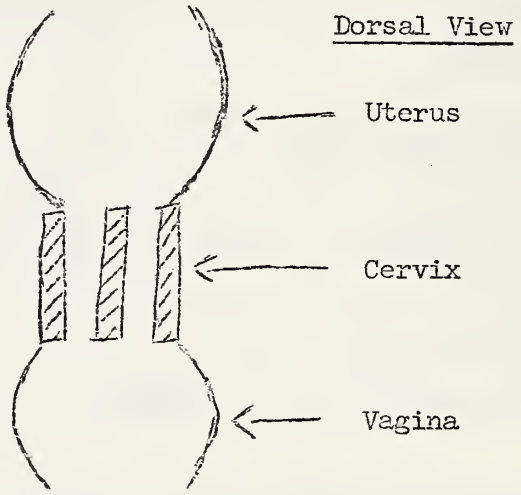
Similarly, if Brae Arden bull 4010 is not used, another bull from the same line will be used as a substitute.

Growth During the Suckling Period

The collection of birth weight, monthly weights to weaning, and body measurements at weaning is being continued for further analysis of factors affecting growth during this period.

Double Cervix

Dr. Kendrick of the veterinary staff, in routine examination of the beef herd's reproductive state, found a cow with a double cervix. This term refers to a condition in which a pillar of tissue divides the cervix into two openings as diagrammed below:



This is a rare anomaly in cattle. Since this is a line bred herd, it was decided to check all the cows. Ten out of 62 cows, or 16 percent, were found to have the anomaly or a slight modification of it. The cows in the University's San Joaquin Experimental Range herd were examined since a long succession of bulls from the Davis herd have been used there. Fourteen out of 191 cows and heifers examined, or 7.3 percent, had double cervixes.

In both herds most of the animals having the condition go back to Dandy Domino 46th on both sides. This by itself is not too meaningful since most of the animals in the two herds also go back to this animal on both sides. However, in an examination of the 85 cows in the University of Nevada purebred Hereford herd only one animal had a double cervix. A cursory study of pedigrees indicates that not any of the animals in this herd traces back to Dandy Domino 46th on both sides.

There is no superficial evidence that this condition lowers reproductive fitness.

Imperial

The crossbreeding experiment continued along the lines outlined in last year's W-1 report. In addition to collecting the kind of data described there, the following meat analyses were made.

From each of 8 crossbred steers and 7 Hereford steers, the following cuts were sent to Davis for analysis: 9th, 10th, 11th and 12th rib; 3" sirloin steak; sirloin tip.

The following analyses were performed by the Food Technology Department: a taste panel studied tenderness, juiciness, flavor, color, and over-all acceptability of the 9th, 10th, and 11th rib cut and of the sirloin steak. A mechanical determination was also made of tenderness, color, and the effect of aging on color. The sirloin tip was used also in this determination.

In the Animal Husbandry Department, the 12th rib was analyzed for the percentage of fat, lean, and bone by the specific gravity method and by boning out. The area of the eye muscle was also determined.

V. Summary of Progress and Conclusions to Date:

Davis

Misshapen Head

During the past several years a small percentage of calves with misshapen heads resulting from a depression of either the right or left temple has been produced in the Rover line. These calves are normal in all other respects.

In 1955 three matings were made to test the hypothesis that this anomaly was due to a recessive gene. A bull with a depressed left temple was mated to two cows with depressed left temples and to one cow with a depressed right temple. From these matings, each of these cows produced a calf with a symmetrical head. Therefore, the hypothesis is rejected.

San Joaquin Experimental Range

Heritability of Long-Yearling Weight

In a continuation of the study described on page 17 of last year's W-1 Report, heritability estimates were made of long-yearling weights of heifers in the A and B herds. Heifers in the A herd were supplemented during the fall and winter postweaning, whereas those of the B herd were not supplemented during this period of deficient range forage. Paternal half-sib estimates of heritability based on 165 herd A heifers and 170 herd B heifers were 48 percent for herd A and -35 percent for herd B. The latter estimate implies a low heritability of long-yearling weight under herd B conditions. These estimates support the thesis that selection for postweaning growth is more effective under adequate than under deficient nutritive conditions.

Imperial

A Comparison of the Performance of 3/4 Hereford - 1/4 Brahman Calves With Hereford Calves

This is a progress report of the results of the first two calf crops. The report will be limited to those traits the comparisons of which have shown significant breed differences and have been similar in both calf crops.

Repeated rectal temperatures taken during the heat of the summer with the animals standing in the shade averaged 104.5°F., for 18 Herefords and 103.0°F., for 13 crossbreds. Ambient temperatures ranged from 92°F., to 104°F., during the tests.

Average daily gain on irrigated pasture during the period of climatic stress from weaning time around July 1 to about October 1 was .65 lb./day for 14 Hereford steers and 1.2 lbs./day for 14 crossbred steers; .65 lb./day for 12 Hereford heifers and .86 lb./day for 16 crossbred heifers.

In the feed lot while on test from about October 1 to April 1, 13 Hereford steers required on the average 118 lbs. less feed per 100 pounds of gain than did 14 crossbred steers. Carcass grades averaged about choice for both groups. Crossbreds dressed out 3.1 percent higher than Herefords. This greater dress-out percentage for the crossbreds did not seem to be due to a thicker fat cover on the carcass, but rather to a relatively smaller digestive tract. Ratios of paunch girth to heart girth and to body weight were significantly smaller in the crossbreds than in the Herefords.

VI. Work Planned for the Future:

Davis

1. The Rover line will be continued to study its performance as the level of inbreeding increases and its relationship to California Rover II is maintained as high as possible.

2. The line resulting from crossing the Rover line to the Brae Arden line will be used either:

   a. In a series of rotational matings using Rover and Brae Arden sires alternately on successive cow generations, or

   b. As a basis for a new cycle of inbreeding and selection.

Imperial

In the crossbreeding experiment two more calf crops will be grown out and marketed. In addition to fattening the steers during the fall and winter as has been done in the past, the heifers will be put in the feed lot for fattening after weaning during the heat of the summer. The results of the first two calf crops clearly demonstrate

the superiority of the crossbreds over the Herefords on pasture during this period.

Meat analyses will be carried out on the marketed animals.

VII. Publications and Manuscripts:

Rollins, W. C., and K. A. Wagnon. 1956. A genetic analysis of weaning weights in a range beef herd operated under optimum and sub-optimum nutritional regimes. J. Anim. Sci. 15:125-133.

_____, and K. A. Wagnon. 1956. Heritability of weaning grade in range beef cattle. J. Anim. Sci. 15:529-536.

_____, and N. R. Ittner. 1956. A comparison of the performance of 3/4 Hereford - 1/4 Brahman calves with Hereford calves. (Ms. completed).

_____, and K. A. Wagnon. 1956. The heritability of size in long-yearling range heifers. (Ms. completed).

PROJECT SUMMARY
Fiscal Year 1956

a. Cattle Inventory
(1) Purebreds

State California
Date May 1956

Line designation	Rover		
Breed	Hereford	Hereford	
Station	Davis	Imperial	
Bulls (12 mos. or over)	32	1	
Cows (2 yrs. or over)	52		
Heifers, yearlings	8		
Bull calves	13		
Heifer calves	14		
Percentage use for breeding project	100	100	
Estimated cash value	$44,700	$600	

(2) Grades

Line designation			
Breed	Hereford	Braford	Hereford
Station	Imperial	Imperial	San Joaquin Exprmntl Range
Bulls (12 mo. or over)	-	-	-
Cows (2 yrs. or over)	18	20	151
Male calves	10	10	((144
Heifer calves	5	9	
Percentage use for breeding project	100	100	25
Estimated cash value	$5,000	$5,800	$40,000

b. Young animals on feed 62 . Animal numbers as of May 1956

(1) Purebreds

	Herefords		Brafords		Shorthorns		
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed	
Bulls	10						
Heifers							
Steers							

(2) Grades

Bulls							
Heifers							
Steers		44		8			

c. Land, physical facilities and equipment used_____.

Item	No.	Actual Cash Value	Percentage use for beef breeding project
DAVIS			
Barns and Corrals	3	$100,000	75 percent
Irrigated Pasture	45 acres		100 percent
Dry Lots	15 acres		100 percent
IMPERIAL			
Barn and Corrals	1	$25,000	50 percent
Irrigated Pasture	160 acres		50 percent
SAN JOAQUIN EXPTL RANGE			
Corrals, Scales and other facilities for handling beef cattle	2	$30,000	25 percent
Foothill Range	5,000 acres		25 percent

d. low production data ____ calves. Data on calf crop weaned summer and fall 1955.

Br.	Hereford	Hereford	Hereford	Braford
Li.	River	X-bred to Angus	Grades-Imperial	Imperial
No. cows bred	20	12	20	21
No. calves born				
(a alive	20	3	16	20
(b dead	1	3	1	0
(c total	21	6	17	20
No. calves weaned	20	3	15	19
Per nt calf crop*				
(a birth	52.5%	25%	85%	95%
(b weaning	52.5%	25%	75%	95%

23.

Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifer No.	Heifer Av
1. rth wt.	10	76.8#	-		10	65.8#			1	56#	2	52#			8	74.8#	7	66.8#			8	64.5#	11	66.
2. eaning age	235 days		-		239 days				121 days		113 days				230 days		234 days				232 days		230 day	
3. eaning wt.	10	585#			9	514#			1	236#	2	199#			8	513#	7	485#			8	530#	11	510
4. eaning wt. (adj.240 days)	590#		-		515#				-		-				529#		486#				536#		522#	
5. ean. score																								
(a) Cond.	-		-		-				-		-				-		-				-		-	
(b) Conf.	-		-		-				-		-				-		-				-		-	

* Low percentage calf crop due in part to outbreak of Leptospirosis.

e. Feed lot performance_____.

Breed	Hereford*	Hereford**	Braford**	Hereford*
Line	Rover	(Imperial) Grade	(Imperial) 3/4 ; 1/4	Grade
Sex	Bulls	Steers	Steers	Steers
No. on test	11	7	8	18
Average:				
Age on test	387 days	325 days	322 days	
Initial weight	695.5 lbs.	589 lbs.	653 lbs.	528 lbs.
Initial score	-	-	-	-
(a) Cond.	Commercial	-	-	-
(b) Conf.	-	-	-	-
Days on test	140	185	185	137
Gain				
(a) Total	357 lbs.	386 lbs.	339 lbs.	340 lbs.
(b) Average	2.55 lbs.	2.09 lbs.	1.83 lbs.	2.48 lbs.
Efficiency of feed utilization (a) #TDN/100# gain	500.3 lbs.	561.5 lbs.	631.8 lbs.	531.5 lbs.
or (b) #Gain/100# TDN	20.1 lbs.	17.8 lbs.	15.8 lbs.	18.8 lbs.
Final weight	1052.6 lbs.	975 lbs.	992 lbs.	868 lbs.
Final score				
(a) Cond.	Low Choice	Choice	Choice	Low Choice
(b) Conf.	2	-	-	-

* These animals completed feed test in summer 1955.
** These animals completed feed test in spring 1956.

Colorado Agricultural and Mechanical College

I. Station: Colorado Agricultural Experiment Station, Fort Collins, Colorado.

II. Project Title: R & M 26, Improvement of beef cattle through breeding. A study of inbreeding and the crossing of inbred lines within the Hereford breed.

III. Personnel: H. H. Stonaker, Kent Riddle, M. H. Hazaleus, T. R. Blackburn, F. C. Daugherty, H. E. Lindholm, M. B. Hughes, R. S. Temple, G. O'Bleness, R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year:

A. Selection indexes for beef cattle, incorporating the genetic and economic importance of various traits.

This year there has been a re-appraisal of the economic importance of the different traits; weaning weight, weaning grade, daily gain, days to finish, slaughter grade, feed per pound of gain, and cost of cow maintenance relative to cow size. The unique feature of indexes computed on these traits has been the technique used in the computation of net income per hundred pounds of beef produced. The data were taken from 118 non-selected steer progeny of 20 purebred Hereford bulls which had been used earlier in size studies. These steers had been individually fed to a constant degree of finish before slaughter. The steers were bred and raised on the Fort Lewis ranch and thus data were available on the characteristics of the dams of the calves, as well as on their own characteristics. Cost-return analyses were based upon ten-year average feed costs and ten-year average prices on good and choice steers on the Denver market. Individual costs and returns were then computed for each animal in the study, allotting each animal his share of the herd costs plus a variable charge depending upon the mature size of his dam as it may be related to the feed charges against an individual steer dependent upon the amount eaten. Heritabilities for the traits studied were high. These heritabilities were based upon paternal half-sib correlations. The ranking of these heritabilities was similar to other studies which have been reported. The genetic correlations were not high relative to the size of the heritabilities. A slightly positive genetic correlation was found between weaning weight and daily gain. Because of the high heritabilities, high correlations between the indexes (I) and aggregate genotypes (H) were found.

These are $R_{I_1}H = .95$, $R_{I_2}H = .95$, $R_{I_3}H = .91$, $R_{I_4}H = .95$, $R_{I_5}H = .91$, $R_{I_6}H = .94$, $R_{I_7}H = .91$ and $R_{I_8}H = .90$. The various indexes resulting from the study were as follows:

$I_1 = + .58W + 18.64G - .73F - 5.87E.$

$I_2 = + .54W + 24.87G - .75F$

$I_3 = + .75W + 24.75G - 9.04E$

$I_4 = + .59W - .75F - 8.46E$

$I_5 = + .70W + 34.80G$

$I_6 = + .54W - .80F$

$I_7 = + .78W - 12.64E$

$I_8 = W$

I = index, W = initial wt. or weaning wt., G = daily gain, F represents days to finish and E represents feed efficiency. Slaughter grade was not included in the index because it showed a heritability of 0 and cow size was not included because the heritability for this trait was not computed. The 0 heritability of slaughter grade indicated that in the 20 Hereford sires used in this study there was no appreciable or significant difference in their ability to sire steers which would at least eventually reach choice grade. While the index was based upon steers individually fed to a constant degree of finish, it was felt that there was a sufficient improvement in the index over that which had been used in the past based upon empirical methods to use it in the ranking of bulls in the experiment at Fort Lewis, the primary differences being that the bulls there are fed on a time constant basis and generally for a shorter period of time than was necessary to finish these steers. Also, it is not understood just what effect sex difference might have upon the index. In spite of these limitations, Index 5 was used for ranking these bulls for breeding purposes. Perhaps the greatest change in the use of this index is the increased emphasis given weaning weight. With phenotypic standard deviations of 67 pounds for weaning weight and .22 pound gain per day, we would give variations in weaning weight 5 to 6 times the importance that we would give daily gain under selection with the new index.

B. Dwarfism studies.

For the second year radiographs have been taken of all calves born at Fort Lewis. The results by breeding groups parallel closely the results in the frist year, Tables 1 and 1a; namely, there does seem to be an association between the genetic history of the line and the appearance of the radiographs of the lumbar regions except for the Brae-Arden line. This line has shown remarkably uniform vertebrae pictures, all of which would be classified at least as extreme as B_2 or B_3 according to the Iowa classification. The entire unselected crop of bulls was profiled May 12, 1956. These were yearling bulls. A comparison of the radiograph interpretation of the vertebrae of these same animals taken at birth was made with the discriminant function 2 reading of the profiles. There was a positive correlation of .29 between the discriminant functions and the scoring of the radiographs. When predictions by each method were compared, there was practically no agreement in the classifications by the two methods (see Table 2).

C. Carcass cut-out and cooking tests are continuing to be run on the youngest half of the heifers produced in the herd each year.

D. The use of the experimental cattle on related projects.

The 1955 bull calves were somascoped at a year of age as they completed their performance tests in the hope that this technique may be useful in determining fat deposition in the young breeding animal. Semen samples were taken again from all bulls at the end of the 1956 performance tests. Under a fertility project being carried on by the Endocrinology Section, amino acid and fructose determinations are being made of the semen as well as the sperm being noted.

E. The control herd has been increased by incorporating nine crossbred Angus-Shorthorn heifers along with the purebred Hereford heifers which were purchased two years ago. The Hereford sire purchased in the Durango purebred sale for use in 1955 sired five dwarf calves out of the control herd this spring. It is planned to continue the control herd, purchasing a new bull each year for the group. The restrictions are that the bull will grade B or better and will be without a progeny test.

F. Interstation line comparisons.

In cooperation with the California Station, herd bulls from the California Rover line and from the Colorado Brae-Arden line are being tested in crosses at the two different stations. In addition, frozen semen from these two bulls was sent to the Codding Ranch, Foraker, Oklahoma, for further test. (Later, it was necessary to destroy this frozen semen). Due to an outbreak of infectious vaginitis, substitutions for the original bulls were made and comparisons of the line crosses will be made between the California and the Colorado Stations. The Rover bull is being mated to a random sample of outcross cows sired by Brae-Arden, San Juan, Don, and La Plata lines. Random samples of cows of this same breeding and age have been allotted to inbred Brae-Arden, San Juan, and Bonanza bulls at Fort Lewis this year.

V. Summary of Progress and Conclusions to Date:

The most important findings in 1955-56 are considered to be a reappraisal of the importance of various characteristics in performance testing of cattle. The recent analysis indicates that importance of weaning weight has been underestimated previously in the selection of performance tested cattle. The other important finding in 1955-56 has been the rather small degree of association between two methods of predicting genotypes of dwarf carriers.

VI. Work Planned for the Future:

It is hoped that meat and carcass evaluation of the cattle on the project can be extended through cooperative projects.

VII. Publications and Manuscripts:

Hughes, M. B. G. 1956. The relationship of lumbar spine radiographs, body measurements, and scores to dwarfism in Hereford calves. M. S. Thesis. Colorado Agricultural and Mechanical College.

Lindholm, Howard B. 1956. Selection indexes for beef cattle, incorporating the genetic and economic importance of various traits. M. S. Thesis. Colorado Agricultural and Mechanical College.

Stonaker, H. H. 1956. Tenth anniversary of Colorado A. & M. research on improvement of beef cattle through breeding. Colo. Agr. Expt. Sta. Gen. Ser. Paper 642.

Table 1. Radiograph prediction 1956 calves.

	♀ Prospector	♀ Monarch	♀ Royal	♀ Brae Arden	♀ San Juan	♀ Animas	♀ La Plata	♀ Fort Lewis	♀ Bonanza	♀ Colorado	♀ Don
♂ Prospector	2 B_3 2 B_2 2 B_1	2CC 1 B_3					2 B_1 2 B_2	1 C 1 B_1 1 B_2			
♂ Monarch	1 B_1	1 C 2 B_1 1 B_2 1 B_3									
♂ Royal			5 C 4 B_1 1 B_2		3 C 1 B_2					3 B_1	
♂ Brae-Arden		1 C	1 C 2 B_1 1 B_2	1(def.)C 1 B_1 3 B_2 4 B_3		1 C 1 B_1 2 B_2					
♂ San Juan				1 C 3 B_1 1 B_2	5 C 1 B_1 - B_2 - B_3						2 C 4 B_1
♂ Bonanza					3 C 2 B_2	3 C 1 B_1 1 B_3			2 C	1 C 2 B_1 1 B_2	
♂ Colorado							1 B_1 1 B_2			3 C 1 B_2	1 C 3 B_1
♂ Don	1 B_2	1 C 1 B_1 - B_2 - B_3						1 C 3 B_1	2 C 1 B_1		

Controls

Buffington:
1 C
2 B_1
2 B_2
3 A

Redd:
2 C
2 B_2
1 A

Townsend:
1 B_2
1 B_3

Black X:
1 B_1

English
2 B_1

Table 1a. Radiograph prediction 1955 calves.

♂ \ ♀	Prospector	Monarch	Royal	Brae Arden	San Juan	Animas	La Plata	Fort Lewis	Bonanza	Colorado	Don	Controls
Prospector	1 A 2 B_3 2 B_2 1 B_1		5 B_2 1 B_1 1 C									
Monarch		4 B_3 1 B_2 1 B_1 4 C						1 B_2 1 B_1 2 C			2 B_3 2 C	
Brae Arden			1 B_3 3 B_2	7 B_2 2 B_1	2 B_2 3 B_1							Buffington 3 C 2 B_1
Animas					3 B_2 3 B_1 3 C^1	2 B_2 2 B_1 3 C^1						Redd: 2 C 1 B_1 5 B_2 1 B_3
La Plata	2 B_2 1 C^2						1 B_3 2 B_1 6 C^1	1 B_2 3 C^2				
Fort Lewis				2 B_2 2 B_1						2 B_1 2 C		Townsend: 2 C
Bonanza	1 B_1 2 C^1								1 B_2 2 B_1 2 C^1			
Mesa							1 B_2 1 B_1 3 C				1 B_1 4 C	
Don				1 B_3 1 B_1 2 C			3 C				1 B_1 6 C	

Table 2. Predictions of yearling bulls' genotypes for +d and ++ using profiles and lumbar radiographs. Colo. AES, May 31, 1956. Unpublished.

Profiles. $D.F._2 = 1.57\ X_1 + X_2$		Radiographs					
		+d	n	++	n	N
	* d 8.5+	5054 BA 5030 BA x R 5034 BA X R 5040 FL -BA 5118 BC 5036 MOD	5070 LP 5060 P * 5064 P * 5072 P * 5042 P-R* 5084 P-R* 5120 P R* 5140 P R* (16)	5050 D 5128 D-BA 5016 MD 5058 M-LP 5068 M-LP 5090 B	5124 MO 5132 MO 5134 MO FL 5048 LP 5014 LP - FL 5002 control 5006 control (15)		31
	5.5 to 8.4		5012 BA 5020 BA 5022 BA 5044 V 5008 B 5102 Control(6)	-5110 D 5116 D 5056 MO-D 5024 LP	(4)		10
	Less than 5.5 ++		5032 BA 5078 BA-R -5146 D BA 5010 V SJ 5018 VSJ -5098 Control(6)	-5092 MD 5026 BC 5052 MO 5076 MO-FL 5126 MO-FL -5074 P* 5100 DB*	(7)		13
	Totals		28		26		54

- = MFP - NFJ

* Sired by dwarf carrier.

$r_{R.P} = .29$ for 48 D.F.

a. Cattle Inventory
(1) Purebreds

PROJECT SUMMARY
Fiscal Year 1956

State Colorado
Date June 11, 1956

Line designation	Animas	Bonanza	Brae Arden	Colorado	Don	Fort Lewis	La Plata	Mesa	Monarch	Prospector	Royal	San Juan	Control
Breed		Hereford				Hereford			Hereford		Hereford		
Station		San Juan Basin				Experimert Station, Fort Lewis A. & M. College, Durango							
Bulls (12 mo. or over)	-	1	1	1	1	-	1	1	1	1	1	1	1
Cows (2 yrs. or over)	13	12	20	14	20	4	16	8	14	13	16	20	18
Heifers, yearlings	9	6	8	-	7	7	8	4	8	2	-	-	7
Bull calves	-	9	11	7	6	-	-	-	3	10	10	10	7
Heifer calves	-	7	9	6	9	-	-	-	6	7	8	8	7
Percentage use for Breeding project	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Estimated cash value													

(2) Grades

Line designation	Control
Breed	Angus x S'Horn
Station	as above
Bulls (12 mo. or over)	-
Cows (2 yrs. or over)	5
Male calves	1
Heifer yearlings	4
Percentage use for breeding project	
Estimated cash value	

b. Young animals on feed 1955 and 1956 .

(1) Purebreds

	Herefords		Angus		Shorthorn	
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	80 (1956)					
Heifers	35 (1955)	(1956) 33				
Steers						

(2) Grades

Bulls						
Heifers						
Steers						

c. Land, physical facilities and equipment used .

Item	No.	Actual Cash Value	Percentage use for beef breeding project
6,000 acres range		$20,000	100%
Sheds, corrals, feeders,			
scales, granaries, etc.		20,000	100
Equipment		5,000	100

d. Cow production data 1955 calves.*

Breed	Hereford	Hereford	Hereford	Hereford
Line	Animas	Bonanza	Brae Ardon	Don
No. cows bred	17	11	20	16
No. calves born				
(a) alive	14	11	16	13
(b) dead	2	-	2	1
(c) total	16	11	18	14
No. calves weaned	13	11	15	12
Percent calf crop				
(a) birth	94	79	90	88
(b) weaning	76	79	75	75

* Inbreds and crosses not differentiated. Percent calf crop calculated on basis of number of females exposed to bulls including yearlings.

Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.
1. Birth wt.		65.4		-		76.6		82.5		-		62.8		89.7		-		85.5		82.3		-		78.6
2. Weaning age		183.4				189.4		197.6				185.0		205.4				196.4		174.5				189.0
3. Weaning wt.		355.8				329.5		448.0				333.8		492.7				465.1		368.7				390.
4. Weaning wt. (adj. 200 days)		472.2				428.9		507.2				421.3		564.3				545.4		477.8				452.
5. Wean. score																								
(a) Cond.		-		-		-		-		-		-		-		-		-		-		-		-
(b) Conf.		-		-		-		-		-		-		-		-		-		-		-		-

d. Cow production data 1955 calves.

Breed	Hereford	Hereford	Hereford	Hereford
Line	Ft. Lewis	La Plata	Mesa	Monarch
No. of cows bred	8	16	10	21
No. calves born				
(a) alive	8	15	10	18
(b) dead	-	1	-	-
(c) total	8	16	10	18
No. calves weaned	8	12	8	15
Percent calf crop				
(a) birth	100	100	100	86
(b) weaning	100	75	80	71

Average	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
1. Birth wt.	65				84.3		72.6				73.8		73.0				64.0		85.6				68.7	
2. Weaning age	204				187.7		200.8				194.4		201.2				199.2		181.6				209.2	
3. Weaning wt.	410				399.8		367.8				365.1		457.2				407.8		394.9				412.0	
4. Weaning wt. (adj. 200 days)	419				456.6		458.8				461.0		471.2				447.2		484.8				460.2	
5. Wean. score																								
(a) Cond.																								
(b) Conf.																								

d. Cow production data 1955 calves.

Breed	Hereford	Hereford		
Line	Prospector	Controls		
No. cows bred	16	16		
No. calves born				
(a) alive	13	13		
(b) dead	-	-		
(c) total	13	16		
No. calves weaned	10	10		
Percent calf crop				
(a) birth	81	100		
(b) weaning	62	62		

Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifer No.	Heifer Av
1. Birth wt.		75.8		-		63.0		65.0		-		60.7										
2. Weaning age		195.6				201.0		203.2				206.5										
3. Weaning wt.		444.7				367.0		376.0				339.3										
4. Weaning wt. (adj. 200 days)		495.8				493.0		406.8				386.5										
5. Wean. score																						
(a) Cond.																						
(b) Conf.																						

e. Feedlot performance _____. (See General Series Paper 642).

f. Phenotypic classification of calves arranged by profile type and by breeding tests of sires and dams 1953, 1954, 1955, 1956 calves.

	Number of Progeny											
	Normal calves			Dwarf calves			Premature or stillborn			Died before 2 months		
	Sire classification by profile			Sire classification by profile			Sire classification by profile			Sire classification by profile		
	+d	++	Int	+d	++	Int	+d	++	Int	+d	++	Int
Proven carrier cows	3			3								
Daughters of proven carrier bulls	11	9						1		1		
Daughters of bulls profiled +d	48	8					4				1	
Daughters of bulls profiled ++	2	2									1	
Daughters of bulls profiled Int	38	13	11				2		1			
Daughters of bulls, classification unknown	288	50	25	4			17	2		7	1	

University of Hawaii

I. Station: Hawaii Agricultural Experiment Station, Honolulu, Hawaii.

II. Project Title: The improvement of beef cattle through the use of breeding methods.

III. Personnel: Oliver Wayman, James H. Koshi, leaders; H. M. Vollrath, assisting, and R. T. Clark, Coordinator, A. Hartwell Carter and assistants (Parker Ranch), Roger Williams (Kukaiau Ranch), L. R. Greenwell (Kahua Ranch), James Beatty and Fred Schattauer (Kaalualu Ranch), Cooperators.

IV. Nature and Extent of Work Done This Year: Collection of routine weaning, 12-months and 20-months data was continued. At Parker Ranch, conformation grades and exact weights were recorded at 240 days and 365 days for 33 bull and 32 heifer calves from six sires and terminal 20-month data on 11 bulls and 24 heifers from 5 sires.

At Kahua Ranch, terminal data were obtained on 32 bull and 29 heifer calves sired by two bulls. These data terminated the project with this cooperator. Correlation coefficients between adjusted weights at the specified ages are being calculated.

On the other three ranches, 240-day data have been collected on 53 male and 73 female calves plus 365-day data on 51 male and 42 female calves from six sires. Twenty-month data on 45 bulls and 57 heifers from nine sires were also recorded. The 20-month data complete testing data on calves from the drought-years period. The number of calves born under the project in 1956 has been greatly increased through the increase in cow numbers on two cooperating projects.

During the year, definite evidence of dwarfism in local herds was obtained. A dwarf Angus heifer has been given to the station for breeding studies. In addition, a herd of grade Herefords has been located that shows a very high percentage of abnormally small offspring without the anomalies generally associated with dwarfism. As many of these small cattle as possible will be obtained for further study. Head profiles have been recorded on each of the sires.

V. Summary of Progress and Conclusions to Date: Data on two calf crops on the ranches of five cooperators have been completed. With withdrawal of one cooperator, analysis of the data from his herds has begun. Adjusted weights for calf crops from the two years of data collected on this ranch are shown in the project summary. Gains made were on unsupplemented range during a period of drought. These data are being analyzed for correlation between weights at the various ages for sires, years, sires by years, and over-all correlation by sexes. The numbers of animals in each category are larger than normally obtained from one sire by natural service. No selection was exercised in allotting cows to the two sires and both herds were grazed under the same conditions.

A set of colored slides is being assembled as a guide for conformation grading. It is very difficult to be consistent in grading from one year to another and from ranch to ranch without reference standards.

Interest on the part of two of the cooperators has increased such that they have increased cow herds under the program to 200 and 300 cows, respectively. On one of the ranches, an improved sorting and handling corral is being constructed based on the Miles City round corral design. Herds have been assigned to the best range on the ranches.

The definite identification of dwarf animals in the Territory has alerted ranchers to this problem. Full cooperation is being given to study the nature and extent of the problem.

VI. Work Planned for the Future:

1. Continue to collect data on range performance of calves at 240 days, 12, and 20 months of age to determine times and selection criteria best suited to economic improvements.

2. Assemble set of colored slides on conformation grades.

3. Test dwarf stocks to determine genetics of characteristics shown.

4. Assist ranchers in obtaining and testing breeding stock to provide lines free of deleterious characteristics.

5. Transfer data to IBM cards and analyze for factors of significance.

VII. Publications and Manuscripts:

None.

a. Cattle Inventory
(1) Purebreds

PROJECT SUMMARY
Fiscal Year 1956

State Hawaii
Date July 5, 1956

Line designation	A 3-	A 4-	A 5-	A 7+	A 8-	A 4+	A 3+	A 6-	A 0-
Breed	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford
Station									
Bulls (12 mo. or over)	5	6	1	1	1	2		1	
Cows (2 yrs. or over)	16	15	15	15	15	15			2
Heifers, yearlings	2	10	4			1	2	5	
Bull calves	3	8	2	3	2	1			
Heifer calves	1	11	3	4	4	2			
Percentage use for breeding project	20	20	20	20	20	20	20	20	20
Estimated cash value	$8,100	$18,900	$7,600	7,200	$7,100	7,250	$300	$1,250	$600

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(2) Grades

Line designation	D1	D2	D3	D4	D5	D171	D175	D295	CM	CO	E7	E19	E20
Breed	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.	Heref.
Station													
Bulls (12 mo. or over)	13	1	3	1	4	10	6	6	12	13	1	1	1
Cows (2 yrs. or over)	34	5	5	2	2	20	Discontinued		30	34	30	30	30
Male calves	?	Heifers used in				?	"	"	10	15	7	10	11
Heifer calves	?	new line D 87				?	"	"	14	13	8	11	13
Percentage use for breeding project	100	-	-	-	-	100	"	"	100	100	100	100	100
Estimated cash value	$10,300+	-	-	-	-	$6,350	+ -	--	$10,800	$12,750	$8,750	$9,350	$9,650

(3) New lines

Line designation	D 87	D- (5 lines)	E- (2 lines)	Dwarf
Breed	Hereford	Hereford	Hereford	Angus
Station				
Bulls (12 mo. or over)	1	5	2	
Cows (2 yrs. or over)	18	150	60	1
Male calves	-	-	-	-
Heifer calves	-	-	-	-
Percentage use for breeding project	100	100	100	100
Estimated cash value	$4,100	$36,150	$14,300	$75

b. Young animals on feed None .

c. Land, physical facilities and equipment used .

Item	No.	Actual Cash Value	Percentage use for beef breeding project	
Portable livestock scale	1	$900.00	90%	
Head profilometer	1 set	$226.20	100%	
Leica camera set	1	$738.42	50%	
Sorting corral		$867.85	100%	

d. Cow production data Kahua calves. 1954

Breed	Hereford	Hereford	Hereford	Hereford
Line	B 4th	B 6th	B 4th	B 6th
No. cows bred	50	50	50	50
No. calves born				
(a) alive	44	41	44	40
(b) dead	-	-	-	-
(c) total				
No. calves weaned	38	38	39	38
Percent calf crop				
(a) birth	88	82	88	80
(b) weaning	76	76	78	76

42 Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.
1. Birth wt.																		
2. Weaning age	263				253		236				256		238				234	
3. Weaning wt.	434				382		411				392		397				393	
4. Weaning wt. (adj. 240 days 1/)	408				372		416				373		399				404	
5. Wean. score																		
(a) Cond.																		
(b) Conf. 2/	5.8				5.8		5.8				5.8		2.9				4	

Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.
227				244	
410				397	
426				388	
3				3.5	

1/ Weight adjustment formula: $\frac{(\text{actual weight} - 70}{\text{days of age}} \times 240) + 70$

2/ Grades: 9 top to 1 bottom

University of Idaho

I. Station: Idaho Agricultural Experiment Station, Moscow, Idaho.

II. Project Title: The improvement of beef cattle through the application of breeding methods: (1) linebreeding within the Hereford and Shorthorn breeds, (2) by testing linebred sires within the various lines which will be developed.

III. Personnel: C. F. Sierk, T. B. Keith, C. W. Hickman, W. P. Lehrer, Jr., and C. W. Hodgson, and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year:

1. Continued gathering routine ROP data on cows and calves.

2. Fed out bull calves individually on ROP test following weaning. Used a completely pelleted ration for the first time with rather disastrous results. The calves bloated occasionally. One had to be removed from the ration. Gains were very poor. A few weeks later three bulls died. It seems that the ration also caused other digestive disturbances which probably caused the death of the bulls. The bulls were then placed on another, more normal ration. They seem to have recovered but are still somewhat small for their age. The performance data probably have very little value.

3. Performance data were used in selection of replacement heifers and in culling the cow herd.

4. Three yearling Hereford bulls were used in a breeding test on some of the University cows. Their calves are now on the ground and performance data will be obtained on them this coming year. One of these young bulls is being used again as a two-year-old.

V. Summary of Progress and Conclusions to Date: Work to date has consisted mainly in getting more production information on the present cow herd and developing facilities and techniques. A major conclusion is that performance data should be used, along with individuality and pedigree, in selection of breeding animals.

VI. Work Planned for the Future: The project has been completely revised, giving greater emphasis to the physiological and genetic aspects and to cooperation with commercial breeders to test out young bulls from the University herds after they have completed an ROP feeding trial.

VII. Publications and Manuscripts: None.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State Idaho
Date June 11, 1956

Line designation	-	-	-
Breed	Hereford	Shorthorn	Angus
Station	Moscow	Moscow	Moscow
Bulls (12 mo. or over)	12	5	4
Cows (2 yrs. or over)	47	31	18
Heifers, yearlings	9	5	6
Bull calves	25	17	6
Heifer calves	16	9	9
Percentage use for breeding project	90	90	90
Estimated cash value	-	-	-

b. Young animals on feed 1955-56.
(1) Purebred

	Hereford	Shorthorn	Angus
	Number individually fed	Number individually fed	Number individually fed
Bulls	11	5	5

c. Land, physical facilities and equipment used.

d. Cow production data 1955 calves.

Breed	Hereford	Shorthorn	Angus
Line			
No. cows bred	49	24	16
No. calves born			
(a) alive	47	24	16
(b) dead	0	0	0
(c) total	47	24	16
No. calves weaned	45	23	14
Percent calf crop			
(a) birth	95.9	100	100
(b) weaning	91.8	95.8	87.5

Average	Bulls		Heifers		Bulls		Heifers		Bulls		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
1. Birth wt.	21	75	26	66	12	58	12	59	9	62	5	62
2. Weaning age	219		217		225		225		218		226	
3. Weaning wt.	20	425	25	389	11	416	12	363	8	419	6	401
4. Weaning wt. (adj. 210 days)	411		379		393		344		406		377	
5. Wean. score												
(a) Cond.												
(b) Conf.												

e. Feed lot performance 1955-56 .

Breed	Hereford	Shorthorn	Angus
Line	-	-	-
Sex	Bulls	Bulls	Bulls
No. on test	9	4	3
Average: Age on test	252	263	245
Initial weight	506	493	498
Initial score			
(a) Condition	-	-	-
(b) Conformation	-	-	-
Days on test	154	151	158
Gain			
(a) Total	257	226	269
(b) Average daily	1.67	1.50	1.70
Efficiency of feed utilization (a) #TDN/100# gain	541	550	538
Final weight	763	719	767
Final score			
(a) Condition	-	-	-
(b) Conformation	-	-	-

Montana State College

I. Station: Montana Agricultural Experiment Station, Bozeman, Montana, and North Montana Branch Station, Havre, Montana.

II. Project Title: The improvement of beef cattle through the application of breeding methods. W-1, M. S. 873, A. I. 104, North Montana Branch Station 71.

A. 1. The establishment of inbred lines of registered Hereford cattle, both horned and polled, that will result in improvement in such characters as rate and economy of gain, fertility, nursing ability, longevity, and carcass quality.

2. Maintain an outbred herd of Herefords with bulls selected and furnished by the purebred breeders. The bulls are to be primarily good, high scoring individuals according to breed association standards.

B. Establishment of an improved herd of registered Angus cattle in which the males are selected on a high level of performance as indicated by standard record of performance procedures.

C. Investigate feasibility of breeding for specific combining ability through recurrent selection.

III. Personnel:

Leaders	Consultants
F. S. Willson, Bozeman	R. T. Clark, USDA, Coordinator
Alva E. Flower, Bozeman	J. R. Quesenberry, USDA, Miles City
Joseph J. Urick, Havre	E. P. Orcutt, Ext. Livestock Spec., Bozeman
	John J. Sturm, N. Mont. Br. Sta., Havre

IV. Nature and Extent of Work Done This Year:

Bozeman

The Angus and Hereford herds are divided into one group sponsored by the respective State Breed Associations and the other herd of each breed is a record of performance herd. Females of each will provide replacements while the males will be selected as provided for in the project. The ROP Hereford herd sires will be line bred and selected by ROP procedures. The ROP Angus herd sires will be ROP bulls from any source, within the breed, available to us. The State Angus Breed Association controlled herd will be headed by bulls selected by the association committee using largely visual appraisal. Both state breed associations are taking increased interest in the breeding program as a result of these breed association sponsored herds.

A selection index is being developed for the ROP herds. Tentatively, we plan to rank the animals in each character to be placed under selection pressure. First, we correct for environmental effects, then weight the ranking for each character according to

the relative selection pressure desired. Second, we combine the weighted rank in each character for each animal to provide an index score which can then serve as a final combined ranking criterion.

Illustrated in table 1 is the ROP information on bulls fed at Bozeman, giving rate of gain on a 5-month feed test, followed by information on the same bulls compiled into a tentative index based on the adjusted final feed lot weight. The assumption is made that perhaps a certain percent of the bull calves will be culled on preweaning information without feeding testing.

There may be some objection to using weight for age as heavily as shown because adjusted final feed lot weight may place too much emphasis on preweaning growth, thus reducing the advantage a commercial producer might provide a buyer of feeder calves. It might be pointed out that calves which do especially well in preweaning growth would require less time to reach the desired weight and grade after going into the feed lot.

Besides the bull indexing work at Bozeman, we fed 11 replacement Hereford heifers, 5 Angus heifers, and 5 Hereford steers. These steers were the bulls from the outbred herd that happened to be sired by a dwarf carrier bull.

North Montana Branch Station - Havre

This was the fourth year of feeding Hereford steer and heifer calves in the recurrent selection trials. The past winter, 38 steer calves representing 7 sire groups were fattened on a standard ration for 196 days and sold locally, where carcass data were obtained. Sixty-two head of heifer calves representing 10 sire groups were wintered for 140 days on straight alfalfa hay. The purebred bull calves, totalling 21 head, were fed individually on a standard ration for 168 days.

Summary of the past winter's feeding program with steers shows slight advantage in daily gain for four of six crossline groups over the Miles City Line 1 steers control group. The latter group, however, this year had more cases of bloat than was noticed in the crossline groups, which probably had some effect on the daily gain.

All of the crossline groups of steers were more efficient in the utilization of feed than was the control group. The cattle in the winter feeding period this year experienced about the usual amount of bloat. The crossline steers were the easier feeders as measured by the occurrences of digestive disturbances.

In the final evaluation of the live animals for score at slaughter and on the rail, there was considerably more variation in the way the steers scored on hoof than the way they were scored on the rail. Slaughter grades between sire groups likewise varied more than carcass grades. On the rail the crossline steers graded slightly higher than the controls. Grading was done by a Federal grader.

Table 1. Bull Index - Bozeman, Montana - 1955-56

Corrected to 180-day weaning age and age of dam

Feeding identification	Dam age	Ear tag	Tattoo	Birth weight (lbs.)	Daily gain Birth-weaning (lbs.)	Correction wt. for calf age and dam age (lbs.)	Corrected wean. wt. (lbs.) 180 days	Daily gain on feed (lbs.)	Final wt. (lbs.)	Final wt. adjusted for age and dam age (lbs.)	Rank wt. for age	Bull grade*	Grade ranking	Relative index 70-30 basis	Weighted combined rank
Herefords															
1 H	7	380	801	80	1.86	-104	416	2.56	921	817	1	78	4	1.9	1
2 H	5	386	812	81	2.03	- 83	447	2.04	858	775	4	77	7	4.9	5
3 H	4	329	816	78	1.92	- 67	424	2.26	836	769	5	85	1	3.8	4
4 H	4	384	814	76	1.85	- 67	409	2.31	835	768	6	75	8	6.6	7
5 H	4	385	813	73	1.59	- 60	359	2.21	782	722	7	80	3	5.8	6
6 H	3	333	820	78	1.85	+ 2	433	2.29	780	782	3	83	2	2.7	3
7 H	2	335	822	73	1.94	+ 28	463	2.37	789	817	1	78	4	1.9	1
8 H	2	340	827	76	1.26	+ 51	331	2.32	610	661	8	78	4	6.8	8
Angus															
9 A	8	348	55	64	2.19	- 48	459	2.37	873	825	3	80	3	3.0	3
11 A	9	346	85	71	2.22	- 17	495	2.16	860	843	2	77	4	2.6	2
12 A	5	347	75	67	2.13	- 40	451	2.21	856	816	4	85	1	3.1	4
13 A	9	382	25	70	2.39	- 77	524	2.21	957	880	1	85	1	1.0	1
10 A	4	401	105	71	1.92	+ 54	416	2.42	697	751	5	77	4	4.7	5

* A. H. Form 522, U. S. D. A.

In comparing the crossline heifer calves with the control Miles City Line 1 heifers on an alfalfa hay ration, there was a similar pattern as in the steers. Four of the crossline groups of heifers outgained the Miles City group and two were slightly below. In final weight, the Miles City heifers had a slight advantage, largely the result of an advantage in weight carry-over from weaning. The heavier weaning weight of the Miles City heifers probably had some effect on their daily gains.

In the bull feeding program the gains varied from a high of 2.3 pounds per day to a low of 1.6. Two high indexing bulls from each of three purebred lines were retained for testing on randomly selected grade cows for the next year. The next 9 bulls were sold at our annual bull sale at Havre. The bottom six indexing bulls were disposed of at a local market for meat.

V. Summary of Progress and Conclusions to Date: Further ROP interest is evident among purebred operators due largely to stimulated interest of feeders in purchase of calves sired by ROP bulls. Last fall there was a tremendous amount of inquiry from feeders throughout the Corn Belt states for these calves and yearlings. Preliminary steps have been taken by breeders in cooperation with the Extension Service to consider the forming of a state association to promote ROP beef cattle.

Hereford calves in the industry-sponsored herd are definitely blockier and shorter legged than in the ROP herd. However, the association committee have been unfortunate in selecting three bulls for us to use that later proved to be dwarf carriers.

North Montana Branch Station - Havre

Attempts are being made to locate cooperative ranchers who will take the crossline heifers for replacement purposes. In their cooperation it would be possible to obtain such valuable data as weaning weights on calves, fall weights of cows, and possible selling price of calves. Personal observations have been made on offspring of some station indexed bulls which were sold to commercial herd owners. Some crosses have been promising, based on visual appraisal and selling prices in some instances. No information on weights has been obtained from outside sources as yet.

VI. Work Planned for the Future:

Bozeman

We are not planning any great change in our work for next year. It is hoped that we can get under way with our top-crossing tests to compare randomly selected sires from the two Bozeman herds on a commercial breeder's cow herd.

North Montana Branch Station - Havre

We expect no changes for the future in our line of work. More emphasis will be placed on the possibility of placing surplus breeding stock in the hands of breeders for additional research information, as mentioned above.

VII. Publications and Manuscripts:

Flower, A. E. 1956. Improvement of livestock for commercial production. College Farmer (Montana State College) June 1956.

Willson, F. S. 1955. Wise bull selection. Bar North (North Dakota Stockgrowers' Association magazine) 3(9):32-33.

_____ 1955. Livestock and range research. Mont. Farmer-Stockman. Aug. 1955.

Urick, J. J., A. E. Flower, F. S. Willson, and C. E. Shelby. 1956. A genetic study of steer progeny groups during successive growth periods. J. Anim. Sci. (Ms. Submitted).

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State Montana
Date 6/1/56

	Havre			Bozeman			
Line designation	H.L. 1	H.L. 2	H.L. 3	A	B	C	D
Breed	Polled Hereford	Horned Hereford	Horned Hereford	Linebred Hereford	Outbred Hereford	R.O.P. Angus	Show-type Angus
Station	Havre	Havre	Havre	Bozeman	Bozeman	Bozeman	Bozeman
Bulls (12 mo. or over)	7	7	5	8	0	6	0
Cows (2 yrs. or over)	17	26	23	25	14	16	12
Heifers, yearlings	8	10	8	7	4	3	2
Bull calves	8	13	8	10	9	8	4
Heifer calves	7	8	10	10	5	5	5
Percentage use for breeding project	100	100	100	60	60	60	60
Estimated cash value	$7,775	$10,225	$8,400	$12,500	$5,500	$8,150	$4,200
(2) Grades							
Line designation	M.C. 1 Tester	X-lines					
Breed	Hereford	Hereford					
Station	Havre	Havre					
Bulls (12 mo. or over)	1	--					
Cows (2 yrs. or over)	102	54					
Male calves	43	20					
Heifer calves	50	25					
Percentage use for breeding project	100	100					
Estimated cash value	$22,400	$11,090					

b. Young animals on feed 1955-56

(1) Purebreds

	Hereford		Angus		Shorthorn	
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	8		5			
Heifers		11		5	None	
Steers		5		-		

(2) Grades: None at Bozeman
Grades: At North Montana Branch Station - Havre

Bulls		--				
Heifers		65				
Steers		51				

(1) Purebreds: At North Montana Branch Station - Havre

Bulls	21					
Heifers		17				
Steers						

c. Land, physical facilities and equipment used 1955-56 .

Item	No.	Actual Cash Value	Percentage use for beef breeding project
BOZEMAN			
Beef barn and corrals	1	$20,000	60
Sheds	4	5,000	60
Irrigated land	200 acres	80,000	100
Saddle horses	2	300	60
Miscellaneous equipment	:	700	60
NORTH MONTANA BRANCH STATION - HAVRE			
Bull barn	1	20,000	100
Long shed	1	20,000	100
Home pasture	1,780 acres	28,000	100
Home farmland	200 acres	6,000	85
Indian pasture	5,500 acres	55,000	100
Truck	1	500	90
Saddle horses	7	700	100
Scale houses	2	2,500	95
Corrals	2 sets	4,500	100
Cabins at mountains	2	2,000	100
Miscellaneous equipment		900	100

d. Cow production data _____ calves. Havre (bred to calve at two years of age).

Breed	H	H	H	H1
Line	All grades	HL1	HL2	HL3
No. cows bred	134	20	32	30
No. calves born				
(a) alive	118	17	27	24
(b) dead	9	0	2	2
(c) total	127	17	29	26
No. calves weaned				
Percent calf crop				
(a) birth	88	85	84	80
(b) weaning	88	85	84	77

Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.
Number			62		58		3		4		12		10		7		12		9		4		12	
1. Birth wt.			80		79		69		66		77		85		70		80		83		74		70	
2. Weaning age			188		191		182		176		178		174		170		183		185		180		181	
3. Weaning wt.			484		470		421		388		396		416		375		422		456		400		416	
4. Weaning wt. (adj. 180 days)			465		447		417		395		398		423		393		418		446		400		414	
5. Wean. score (a) Cond.																								
(b) Conf.			78		78		70		68		73		74		72		78		78		73		80	

d. Cow production data 1955 calves. Bozeman (bred to calve at two years of age).

Breed	Hereford	Hereford	Angus	
Line	A Linebred	B Outbred 2	C	
No. cows bred	24	12	24	
No. calves born				
(a) alive	20	10	13	
(b) dead	2	0	3	
(c) total	22	10	16	
No. calves weaned	19	9	12 1/	
Percent calf crop				
(a) birth	83.3 (alive)	83.3	54.2	
(b) weaning	79.2	75.0	50	

1/ One bull failed to settle cows.

Average	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Steers No.	Steers Ave.	Heifers No.	Heifers Ave.
1. Birth wt.	9	76.8			11	75.5	5	75.6			5	71.0	5	68.0			8	65.3
2. Weaning age		205.9				194.4		222.0				226.8		195.0				191.0
3. Weaning wt.	8	447.8			11	357.8	5	476.6			4	478.0	5	495.0			7	379.3
4. Weaning wt. (adj. 180 days)		398.5				340.0		395.8				394.8		459.0				355.6
5. Wean. score																		
(a) Cond.														None				None
(b) Conf.	8	80.4			11	76.8	5	79.3			4	86.3	5	83.0			7	77.0

e. Feed-lot performance 1955-56 . Bozeman (bull indexing).

Breed	Hereford	Hereford	Angus
Line	A Linebred	B Outbred	C
Sex	Bulls		Bulls
No. on test	8	0	5
Average:			
Age on test	243	0	232
Initial weight	480.0	0	530.2
Initial score			
(a) Cond.	--		--
(b) Conf.	80.4	0	84.0
Days on test	140	0	140
Gain			
(a) Total	2570	0	1592
(b) Average	321.25	0	318.40
Average daily gain	2.29	0	2.27
Efficiency of feed utilization			
(a) #TDN/100# gain	--		--
or (b) #Gain/100# TDN	22.4	0	19.8
Final weight	801.38	0	848.60
Final score			
(a) Cond.	--		--
(b) Conf.	79.25	0	80.8

e. Feed-lot performance (bull calves, R.O.P.)_____.

Breed	H	H	H
Line	HL1	HL2	HL3
Sex	Bulls	Bulls	Bulls
No. on test	3	9	9
Average			
Age on test	222	214	225
Initial weight	450	435	481
Initial score	70	74	78
Days on test	168	168	168
Gain			
(a) Total	292	315	310
(b) Average	1.74	1.87	1.84
Efficiency of feed utilization			
(a) #TDN/100# gain	-	-	-
or (b) #Gain/100# TDN	20.1	21.9	20.5
Final weight	742	750	791
Final score	70	74	79

e. Feed lot performance 1955-56 . North Montana Branch Station, Havre (steers, R.O.P.).

Breed	H	H	H	H	H	H	H
Line	MC1	HL1xMC1	HL1xMC1	HL2xMC1	HL2xMC1	HL3xMC1	HL3xMC1
Sex	Steers	Steers	Steers	Steers	Steers	Steers	Steers
No. on test	8	4	3	7	7	5	3
Average:							
Age on test	200	181	182	194	201	199	197
Initial weight	473	411	430	472	447	483	462
Initial score 1/	78	73	77	79	76	85	82
(a) Cond.							
(b) Conf.							
Days on test	196	196	196	196	196	196	196
Gain							
(a) Total	381	372	383	416	410	415	411
(b) Average	1.94	1.90	1.95	2.13	2.09	2.12	2.10
Efficiency of feed utilization							
(a) #TDN/100# gain							
(b) #Gain/100# TDN	19	20	21	21	22	22	23
Final weight	854	783	813	888	857	898	873
Final score 2/							
(a) Cond.							
(b) Conf.	13	14	12	12	13	11	12

1/ A. H. Form 522, U.S.D.A.
2/ FDA-BAI-ARA Form No. 102, U.S.D.A. Carcass grade.

University of Nevada

I. Station: Nevada Agricultural Experiment Station, Reno, Nevada.

II. Project Title: The effect of environment on selection for traits of economic importance, the relative value of several selection criteria, and reproductive studies in range beef cattle.

III. Personnel: James F. Kidwell, leader; H. J. Weeth, V. R. Bohman, J. E. Hunter, C. R. Torell, assistants; J. H Robertson, J. D. Mankin, W. B. Dye, J. A. McCormick, cooperators; permanent and temporary farm labor, student assistants; R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year: Routine operation and collection of data required the majority of available time and effort. All calves are individually fed during a standard 140-day test period.

In cooperation with Agricultural Marketing Service, an intensive investigation of the relation between conformation, rate and economy of gain, and carcass quality was initiated in 1954. Fifty-four steers were fed in 1954-55 and fifty-one in 1955-56. Each year an attempt was made to obtain ten steers of each of the following grades: Choice, good, medium, common, and inferior. They were individually fed a standard fattening ration. Half of each grade was fed for 84 days and half for 140 days. Each steer was weighed, graded in accordance with the system established by Guilbert, and the following body measurements obtained: height at withers, height at hocks, round, length chest width, width at hocks, and heart girth. The same scores and measures were taken at the conclusion of the feeding period. Carcass data include: dressing percent, shrink, carcass weight and grade, and weight of round, loin, rib, chuck, and plate. The percent bone, muscle, and fat in the 9th, 10th, 11th rib were also determined. This year, the 7th and 8th ribs were broiled and evaluated by a panel for tenderness of muscle, flavor of muscle, flavor of fat, flavor of juice, and quantity of juice.

The data have been summarized and prepared for analysis by means of the California Digital Computor, an electronic device. The analysis will be initiated in June 1956. It is anticipated that it will provide further information concerning:

1. The relationship among the components of feeder and slaughter scores.

2. The relations among the body measurements studied.

3. The relation between body measurements and rate and economy of gain and carcass quality.

4. The relation between slaughter grade and carcass quality.

5. The relations between feeder grade and subsequent rate and economy of gain and carcass quality.

Blood fat was determined immediately prior to slaughter in each of the fifty-one steers fattened this year. It was determined that no correlation exists between blood fat, expressed as milligrams percent, and percent fat in the 9th, 10th, 11th rib cut. A relation between blood fat and body fat would be of considerable value.

In 1954 an investigation was initiated to study the possible use of filter paper electrophoresis to identify individuals heterozygous for the gene which conditions dwarfism. Last year, installation of equipment necessary for detailed analysis was completed. Blood samples were obtained from the dwarf herd maintained at the University of California. No difference in migration patterns was detected.

The studies of growth and form at this station frequently involve a measure or measures of body length. This has been measured with a corded linen tape. The distance between the point of the shoulder, parallel to the ground, and a point perpendicular to the pin bones has been determined. This is not entirely satisfactory. There is considerable measurement error. Moreover, it is often desirable to measure segments of length along the top line, for example, rump, loin, and back. A rather simple caliper has been designed and fabricated for this purpose. Similar devices undoubtedly exist.

The location of the herd at Reno has been changed during the past year. The property on South Virginia Road, which has served as the Reno laboratory since the project's inception, was sold. A 1,040-acre farm, designated as the Main Station Farm, was purchased. It is located southeast of Sparks in a low, wet, alkaline area. It has many buildings, corrals, etc., in varying states of repair. It was not, of course, designed as an animal science research laboratory. It has been announced that such development will be accomplished in the near future.

V. Summary of Progress and Conclusions to Date:

A rather comprehensive review of the progress and conclusions through June 30, 1955, appeared in the 1955 report. The work of the past year has added to the general fund of information resulting from the project.

VI. Work Planned for the Future: Future work has been largely determined by the project outline. It will, for the most part, be aimed at accomplishing the objectives of the project. Related problems continue to arise and will be studied as time, facilities, and personnel are available. Major emphasis during the coming year will be placed on analysis, interpretation, and publication of available data relating to conformation, growth, and carcass merit. (See IV. above). It is possible that the analysis of early allometric growth might also be completed.

VII. Publications and Manuscripts:

Kidwell, J. F., M. A. Wade, and J. E. Hunter. 1955. The relation of blood glutathione level to grwoth and body size in beef cattle. (Abs.) J. Anim. Sci. 14:1185. Growth XIX:177-185.

_____ and J. A. McCormick. 1956. The influence of size and type on growth and development of cattle. J. Anim. Sci. 15:109-118.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State Nevada
Date June 1, 1956

Line designation	I R	II R	III R	I K	II K
Breed	Hereford	Hereford	Hereford	Hereford	Hereford
Station	Reno	Reno	Reno	Knoll Creek	Knoll Creek
Bulls (12 mo. or over)	2	2	2	2	2
Cows (2 yrs. or over)	29	30	30	24	25
Heifers, yearlings	3	3	3	4	5
Bull calves	12	13	14	6	7
Heifer calves	11	10	11	8	6
Percentage use for breeding project	95	95	95	100	100
Estimated cash value	$9,000.00	$9,000.00	$9,000.00	$8,000.00	$8,000.00

b. Young animals on feed 1955-56 .
(b) Purebreds

	Hereford		Angus		Shorthorn	
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	24	-	-	-	-	-
Heifers	30	-	-	-	-	-
Steers	-	-	-	-	-	-
(2) Grades						
Bulls	-	-	-	-	-	-
Heifers	-	-	-	-	-	-
Steers	51	-	-	-	-	-

c. Land, physical facilities and equipment used 1955-56 .

Item	No.	Actual Cash Value	Percentage use for beef breeding project
Reno station	1	$725,000.00	80
Knoll Creek Station	1	100,000.00	80
Laboratories, etc.	3	100,000.00	50

d. Cow production data 1955-56 calves. Not available at this time.

e. Feed lot performance 1955-56 . Data not available.

f. Phenotypic classification of calves arranged by profile type and by breeding tests of sires and dams, 1955-56 . Nevada herd not classified.

New Mexico College of Agriculture and Mechanic Arts

I. Station: New Mexico Agricultural Experiment Station, State College, New Mexico.

II. Project Title: Breeding beef cattle for southwestern ranges.

III. Personnel: R. L. Blackwell, J. H. Knox, and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year: Additional data have been collected on weaning traits in the range and purebred herds, feed consumption and gains of bulls individually fed, type steer calves group fed, heifer calves group fed, and carcass data on type steers. Additional descriptive information on a lethal condition in the outcross line has been obtained along with further evidence on the genetic basis for the condition.

One bull with a carrier profile was mated to a herd of cows heterozygous for the "snorter" dwarf gene in 1955. Another bull with a carrier profile is now being mated to these same cows. This last bull has sired abnormal calves in the New Mexico herd. These breeding tests are being done at the Arizona station.

Essentially all of the production data at the station pertaining to this project have been tabulated and punched on IBM cards. Analyses of these data are being continued in cooperation with Dr. C. E. Shelby and Dr. R. T. Clark.

The age incidence of cancer-eye and the heritability of susceptibility were investigated. Incidence of cancer-eye increased with advancing age after five years of age. A score for cancer-eye susceptibility was developed based on the age when cancer develops. The assumption underlying the development of the score is that animals which develop cancer at a relatively young age are more susceptible than those that develop cancer at more advanced ages. Those that never develop cancer-eye in advanced ages (12-14 years) are considered even more resistant. Estimates of the heritability of cancer-eye susceptibility based on the score ranged from 0.17 to 0.30. This material has been prepared for publication.

Weaning data (weight, grade, and condition) obtained from calves produced by the reciprocal matings of large and compact types of cows and bulls showed that the matings of large cows x compact bulls produced heavier and fatter calves than did the mating of compact cows x large bulls. Differences between the type of dam were greater than those between type of sire. This finding is further evidence of the importance of maternal effects on weight and condition of calves at weaning. The results of this preliminary study of two years' data involving 95 calves are shown in Table 1. Condition scores and grade scores were fairly highly correlated ($r = 0.64$). The correlation obtained between weight and condition score was 0.50.

Additional data on lifetime production have been added to that summarized previously on the effect of selection for weight as compared to selection for compactness and grade. These records were collected in the past 9 years when the average rainfall was less than 7 inches. This more recent summary is presented in Table 2.

The relationship between color score and measures of performance in Hereford cattle has been studied. There was no correlation that was significantly different from zero, indicating that there is no relationship as measured in these data. Averages for the various traits studied are given in Table 3 for each of three color classifications.

A summary of the feed lot performance and carcass data for steers of the two types is given in Table 4 and Table 5.

V. Summary of Progress and Conclusions to Date: Selection of range breeding cows on the basis of weight for age is effective. Weight for age is positively associated with lifetime calf production, especially in regard to regularity of production, when the cattle are under stress conditions of drought. Other differences between cattle selected for size vs. compactness and grade are small. Cattle that are selected for size and fed for approximately 200 days following weaning yield carcasses that are slightly fatter and yield essentially the same percentage of high-priced cuts (round, loin, rib). There is no real difference in apparent efficiency of feed conversion, while daily gains are approximately 0.1 pounds per day more for the large type.

Cancer-eye, a serious problem in the southwest, increases in incidence with advancing age. The susceptibility to cancer-eye is approximately 25 percent heritable.

VI. Work Planned for the Future: The New Mexico contributing project is being revised. Emphasis will be placed on obtaining longer bodies of data for estimating more precisely the heritabilities, and genetic and phenotypic correlations for traits of economic importance. Selection techniques and indexes will be developed. The effects of mild inbreeding on productive traits will be studied. The adaptability of strains or lines of cattle to semi-arid ranges of the southwest will be investigated. Improvement resulting from different selection procedures will be studied.

Cancer-eye will be studied in regard to heredity, measures of susceptibility, types and locations of eye lesions, age when lesions develop, and rate of development.

Analysis of existing data and preparation of manuscripts for publication will continue.

VII. Publications and Manuscripts:

Blackwell, R. L. 1955. The effect of condition on evaluating type in range cattle. Ranch Day (Report). Oct. 10, 1955.

_____ 1956. The principles of inheritance. Cattle Breeders' School. February 28 and 29, 1956.

_____ 1956. Mating systems. Cattle Breeders' School. February 28 and 29, 1956.

_____ and Estel Cobb. 1956. Effect of type on feed lot performance and carcass merit. Feeders' Day Report. February 28 and 29, 1956.

Blackwell, R. L. 1956. Inheritance of productive traits in beef cattle. Cattle Breeders' School. February 28 and 29, 1956. New Mexico Stockman. May 15. West Texas Livestock Weekly.

_____, David E. Anderson, and J. H. Knox. 1956. Age incidence and heritability of cancer-eye in Hereford cattle. J. Anim. Sci. (In press.)

Hurt, Paul. 1956. Relationship between intensity of red color and performance in Hereford cattle. Feeders' Day Report. February 28 and 29, 1956.

Knox, J. H. 1955. The steer of the future. Natl. Live Stock Prod. 33(4):8,24. Feb. 1955.

_____ 1955. Research for cattlemen in the Southwest. Arizona Stockman. June 1955.

_____ 1955. The effect of selecting for type and size on the production of range cows. The Rural New Yorker. August 1955.

_____ 1955. Rapid gains--better grades--more money! Good gains make good grades. Shorthorn World 40(10):46, 324. August 15, 1955.

_____ 1955. Selecting cows by weight of their calves. Ranch Day (Report). Oct. 10, 1955.

_____ 1955. Some factors affecting carcass grade.

_____ 1955. What size range cows?

_____ 1956. Type of cattle from the rancher's viewpoint. Cattle Breeders' School. February 28 and 29, 1956.

Stewart, Floyd. 1955. Heritability of carcass characteristics, and a comparison of types of Hereford steers. M. S. Thesis. New Mexico College of Agriculture and Mechanic Arts.

Table 1. Weaning Weight, Grade, and Condition Scores of Calves from the Various Matings.

	Type of Cows	Type of Bulls Big	Compact	Average
Weaning Weight. lbs.	Big	317.2	323.9	320.6
	Compact	273.1	281.8	277.4
	Average	295.2	302.8	299.0
Grade, Score	Big	6.43	7.02	6.72
	Compact	6.43	6.75	6.59
	Average	6.43	6.88	6.65
Condition, Score	Big	5.42	6.36	5.89
	Compact	5.14	5.50	5.32
	Average	5.28	5.93	5.60

Table 2. Lifetime Production of Range Cows.

	Compact	Big
Number of cows	78	69
Average age removed from herd	7.1	8.1
Total calving periods	397	415
Number of calves born	324	399
Calving percentage	81.7	96.1
Calves died of natural causes	25	20
Calves died of accidental causes*	1	6
Number of calves weaned	298	373
Percentage of cows which weaned calves	75.1	90.0
Average number of calves born per cow	4.2	5.8
Average number of calves weaned per cow	3.8	5.4
Average weight of calves, lbs.	377	401
Average annual production per cow, lbs.	283	361
Average lifetime production per cow, lbs.	1445	2176

* Two by lightning, 2 by coyotes, 2 by over-heating.

Table 3. Averages for the Various Traits by Color Score Groups.

	Dark	Medium	Light	Approximate Range
		Yearling Steers		
Number of steers	42	95	50	
Weaning weight	407	411	415	160
Weaning grade	6.4	6.4	6.5	3.4
Yearling weight	668	658	671	211
Yearling gain	262	247	256	139
Yearling grade	6.4	6.5	6.3	3.3
Feedlot gain (168 days)	391	386	383	187
Final weight	1061	1053	1056	318
Fat grade**	5.7	5.4	5.3	1.8
Dressing percentage***	56.1	55.6	55.8	6.7
Carcass grade**	4.5	4.6	4.5	4.4
Carcass weight	596	586	590	207
		Calves		
Number of calves	28	68	36	
Weaning weight	414	402	396	117
Feed lot gain	400	393	408	167
Final weight	814	805	802	227
Fat grade	5.1	5.4	5.3	4.2
Carcass grade	4.6	4.6	4.8	4.2
Dressing percentage	55.0	54.9	54.6	5.8
Carcass weight	450	443	439	142

Table 4. Effect of Type of Cattle on Feed-lot Performance.

	Large	Compact
Number of calves	67	65
Average weaning age, days	204	199
Average initial weight	433	380
Average weaning grade*	6.5	7.2
Average daily gain	2.05	1.93
Final weight	843	768
Fat grade**	5.3	5.4
Total Digestible Nutrients Per 100 lbs. gain	520	508
Total Digestible Nutrients Consumed per 100 lbs. Live Weight	338	344

* Higher number indicates higher grade.
** 5 - high good, 6 - low choice, 7 - choice grade.
*** Dressing percentage based on feed-lot weight.

Table 5. Effect of Type of Cattle on Carcass Merit.

	Large	Compact
Number of steers	35	36
Carcass grade	5.2	4.5
Rib fat thickness, mm[2/]	9.8	8.0
Dressing percentage	54.6	54.0
Carcass weight	452	406
Percent[3/] of		
Round	24.5	25.4
Loin	17.2	17.1
Rib	9.3	9.4
High-priced cuts[4/]	51.0	51.9
Chuck	26.8	27.2
Lower cuts[5/]	19.0	18.2
Low-priced cuts[6/]	45.8	45.4
Kidney knob, cutting loss, etc.	3.2	2.7
Length forearm, inches	14.0	13.5
Depth carcass at 6th rib, inches	22.5	21.9
Length of carcass, inches	44.1	42.5
Length of carcass/depth of carcass	1.96	1.94

1/ Low prime - 9, high choice 8, choice 7, low choice 6, high good 5, good 4, low good 3, high commercial 2, commercial 1, and low commercial 0.

2/ Rib fat thicknesses are based on only three years' work and 28 and 30 steers, respectively.

3/ Percentages were calculated using carcass weight.

4/ Loin, rib, and round.

5/ Plate, brisket, and flank.

6/ All lower cuts plus the chuck.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State New Mexico
Date June 1, 1956

Line designation	Old Line	Out Cross Line
Breed	Hereford	Hereford
Station	Main	Main
Bulls (12 mo. or over)	6	7
Cows (2 yrs. or over)	20	41
Heifers, yearlings	4	16
Bull calves	5	2
Heifer calves	4	4
Percentage use for breeding project	65	65
Estimated cash value	$10,350	$20,100

(2) Grades

Line designation	Big	Medium	Compact
Breed	Hereford	Hereford	Hereford
Station	Main	Main	Main
Bulls (12 mo. or over)	0	0	0
Cows (2 yrs. or over)	31	54	27
Heifers, yearlings	3	18	3
Bull calves	10	17	11
Heifer calves	12	18	12
Percentage use for beef breeding project	50	50	50
Estimated cash value	$4,190	$8,060	$3,830

b. Young animals on feed 1955-56 .
(1) Purebreds

	Hereford	
	Number individually fed	Number group fed
Bulls	15	0
Heifers	0	28
Steers	0	12
(2) Grades		
Bulls	0	0
Heifers	0	23
Steers	0	20

c. Land, physical facilities and equipment used 1955-56 .

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Range land	63,000A	$189,000	33	
Farm land	52A	52,000	33	
Feed lots		30,000	50	
Barns	2	50,000	80	
Meat Laboratory	1	100,000	10	
Pathology Laboratory	1	40,000	15	
Calculators	4	2,800	60	
Office Equipment		600	60	

Oregon State College

I. Station: Oregon Agricultural Experiment Station, Corvallis, Oregon.

II. Project Title: Improvement of beef cattle through the application of breeding methods.

Subproject Titles:

Completed and Reported

1. The effect of such factors as birth weight of calf, suckling gains, age put on test, weight on test, and score on feed-lot performance (Union and Central Stations).

2. The effect of the male hormone (testosterone) on rate of gain, feed efficiency, and carcass characteristics.

Subproject in Effect

3. The development of a selection index for improving beef cattle.

4. The growth pattern of calves differing in rate and efficiency of gains.

5. The relation of nitrogenous and carbohydrate constituents of blood and urine to rate and efficiency of gains.

6. Further studies on heritabilities of production characteristics in beef cattle.

7. The relation of body scores and measurements to rate of gain, feed efficiency, and carcass characteristics.

8. Application of selection for greater rate and economy of gains on a ration composed primarily of roughage (Squaw Bute and Central Stations).

9. The development and use of inbred lines of beef cattle.

10. The relation of feed digestibility to rate and economy of gain.

The subproject numbers will be used as reference in all material included in this report.

III. Personnel:

Ralph Bogart, Leader)
Hugo Krueger)Central
A. W. Oliver, J. E. Oldfield)Station,
John Kaufmes, G. E. Nelms)Corvallis,
D. A. Price, R. W. Mason)Oregon
Hugh Nicholson, Floyd Pahnish)

R. T. Clark, C. E. Shelby
U. S. Department of Agriculture.
W. A. Sawyer, Warren Brannon,
Squaw Butte-Harney Station,
Burns, Oregon.
H. G. Avery, Cecil Pierce,
Eastern Oregon Branch Livestock Station, Union, Oregon.
E. N. Hoffman, Malheur Experimental Area, Ontario, Oregon.

Departments and Cooperating Agencies:

Department of Animal Husbandry
Squaw Butte-Harney Branch Station
Eastern Oregon Branch Livestock Station
Malheur Experimental Area
Agricultural Research Service, U. S. Department of Agriculture
Other Western States

IV. Nature and Extent of Work Done This Year:

3. Accumulated more data on suckling gains, feed-test gains, feed efficiency, and score, in order that sufficient data could be available for developing a sound index.

4. Calves have been weighed weekly from birth to a weight of 800 lbs., and some to a definite plateau in the slope of the growth curve, to obtain data for developing a mathematical description of growth in beef cattle. The growth curve of the best gaining and slower gaining calves will be compared with this standard.

5. Continued the injection of 2 grade Hereford heifers with testosterone, 1 mg./kg. body weight per week. The injections were commenced in 1954, when the heifers weighed 200 and 300 lbs. Observations have been made on rate of gain and responsiveness to the male, digestibility, blood uric acid, urea, amino acids, hemoglobin, creatine, 17-ketosteroids of the urine, and amino acids of the urine.

Collected 24-hour urine excretion from each of 49 individuals which had been feed tested. The collections were made prior to and immediately following the feed test. All urine samples were analyzed for 17-ketosteroid concentration.

Blood samples were taken at 500 lbs., 650 lbs., and 800 lbs. body weight. Specific gravity, hemoglobin, urea, amino acids, creatinine, and uric acid were determined from all samples.

A urine-collecting apparatus was developed for collecting urine from bulls and heifers.

Continued the chromatographic study of blood and urine, concentrating the efforts mainly on the amino acids of the urine.

Related EKG records obtained on 30 Hereford and 6 Angus calves to performance.

Correlated the values for blood and urine constituents (creatine, creatinine, urea, uric acid, amino acid, etc.) at 500 and 800 lbs. body weight with rate and efficiency of gains.

Determined protein-bound iodine, serum volume, and clot volume on all calves at 800 lbs. body weight for relating to rate and efficiency of gains.

Injected lactating females with testosterone and observed the influence of this upon growth rate of the young while nursing, and post weaning.

Obtained pituitaries for assay for gonadotropic, thyrotropic, and growth hormone content from animals receiving low and adequate protein and from animals fed diethylstilbestrol and their corresponding controls.

6. Initiated a selection experiment with mice as a pilot trial to be applied to beef cattle. Mice have been selected for increased and decreased body weight at 45 days of age on the individual basis and on the basis of the weight of the dam. One group is acting as control to these four groups since breeding stock is selected randomly.

Attempted to determine genetic and environmental correlations and heritabilities from the Oregon data (in conjunction with Drs. Clark and Shelby), but found that the data would not lend themselves to these analyses.

Prepared Squaw Butte data from records covering a 20-year period for IBM card punching and analyses. The IBM analyses are to be done in cooperation with Drs. Clark and Shelby.

Continued the study using rabbits in which the cytoplasmic material, maternal effects both prior to and following birth, and postweaning environments are held constant with genetics varying. New Zealand does are mated to bucks of Polish (2 to 3 pounds mature weight), New Zealand (9 to 10 pounds mature weight), and Flemish Giant (16 to 20 pounds mature weight). The young are studied for gains, feed efficiency, and body weight, growth curves, and weights of endocrine glands. The study now involves prenatal growth of young of the three genetic groups.

Continued study on blindness in the Angus cattle to see if the eye trouble is due to an inability of the animals to convert carotene into vitamin A. Eyes of cattle are being studied and carotene and vitamin A of the blood are being determined.

All calves that die or are born dead are examined very carefully for dwarfism; particulary, the head is opened for hydrocephalic examination.

Cooperated with the extension personnel in profiling bulls to differentiate dwarf carriers from clean ones as a service to breeders. The profiles are taken by the extension men and keyed out in the laboratory.

7. Correlated body measurements and scores with rate of gain and feed efficiency.

Scored, measured and photographed, using a 6" grid behind which the animal stands, all animals at 500 pounds when they started on feed test and again at 800 pounds when they completed the feed test.

8. Individually-fed heifers at two levels of TDN intake at Squaw Butte to determine their rates and efficiencies of gain. This will be done for four consecutive years and the heifers will all be kept in the breeding herd. Their calves will be evaluated for rate and efficiency of gains to determine if the genetically superior animals can be detected on a feed test of roughage feeding or if a higher plane of TDN is necessary.

   Analyzed data obtained at Squaw Butte over a 4-year period when animals were fed at different levels of TDN intake.

9. Continued the development of three lines of Hereford and one line of Angus at the Central Station, selecting for fertility, suckling gains, feed-test gains, feed efficiency, score, and freedom from defects. All animals, both male and female, are feed tested.

10. Analyzed the data on the relation of digestibility of feed to rate and efficiency of gains.

V. Summary of Progress and Conclusions to Date:

Major Accomplishments or Progress of Project Since Its Inception:

Central Station:

Heart rate and body temperature seem to be related to rate and efficiency of gains. The better-performing groups of cattle have a higher heart rate and body temperature.

Bulls gain faster and require less feed than steers; and steers, in turn, are superior in this respect to heifers. It appears that a portion of this difference between the heifers and bulls is attributable to the male sex hormone. Testosterone at a dosage level of 1 mg./kg. body weight per week injected intramuscularly during the test period from a weight of 500 pounds to a weight of 800 pounds increased the rate of gain and reduced the feed necessary for making each unit of gain in both heifers and steers. Heifers treated with testosterone responded with a greater increase in rate and economy of gain over the control heifers than the testosterone treated steers over the control steers. The heifers were not brought up to the level of normal bulls, whereas the steers were. The nonmasculinizing male hormone, methyl androstenediol, had no significant effect on rate and economy of gain; therefore, it appears that rate and efficiency of gain may be associated with the masculinizing principle of the male hormone. Methyl testosterone fed to steers at the rate of 1.5, 2.0, and 6.0 grams per 100 pounds concentrate with the allowance of concentrate at 0.8 pound per 100 pounds live animal weight did not statistically increase rate of gain and feed efficiency but it did cause some masculinizing and did affect the carcass by increasing nitrogen and reducing fat storage. The variation in this group of steers was great, which may account for gain and efficiency figures showing nonsignificance.

There seems to be little relation between rate or economy of gain and scores for conformation. This is encouraging in that it appears possible to secure good-appearing cattle that are rapid

and efficient in their production. The relation of rate of gain to feed efficiency is very close; therefore, the ranchers who select only for rate of gain will get a good bit of improvement in economy of gains also.

Squaw Butte-Harney Station

Larger cows wean heavier calves than smaller ones.

Correction factor of 1.29 pounds per day for adjusting the weaning weights of range beef calves to a constant age basis has proved accurate.

Cancer-eye seldom, if ever, occurs in "red-eyed" Herefords.

Studies on selection showed that selecting for larger animals as yearlings would result in large adult animals and cows that raised larger calves to weaning. Heritability of yearling weight is sufficiently high that some progress from individual selection would be made; however, the use of additional information, such as records on progeny or other relatives, would increase the effectiveness of selection for yearling weight.

Eastern Oregon Station

During a three-year period ending in June 1952, bull calves have averaged 0.29 pound per day increase in average gain on test, and have increased in efficiency of gain by an average decrease of 60 pounds TDN for each 100 pounds gain in live weight.

Statistical analysis of these three-year data shows the following:

With individually-fed calves

(a) Birth weight had a significant effect on gain on test, and on gain from birth to the end of test.
(b) Weight on test had a significant effect on total gain from birth to the end of test.
(c) Age on test had a significant effect on gain on test.
(d) Suckling gain had no effect on gain on test, economy of gain, or total gain from birth to the end of the test period.
(e) Neither birth weight, suckling gain, nor weight on test, or age on test, had any effect on economy of gain during the test period.
(f) There was a significant regression of economy of gain on rate of gain.

With group-fed calves

(a) Birth weight had a significant effect on gain on test and total gain.
(b) Suckling gain had a significant effect on gain on test and total gain.
(c) Weight on test had a significant negative effect on gain on test and a significant positive effect on total gain.

Major Results for the Year:

3. The data were analyzed but it was found that if line effects were removed sire effects were also partly removed and, therefore, negative heritabilities were obtained. If line effects were not removed, the effects of sires contained line effects; therefore, heritabilities over 100 percent were obtained. This was the result of using only one sire per line in several instances.

4. The growth from birth to weaning is linear for each calf but the slope of the growth curve varies between calves and between lines. Growth from a weight of 500 to a weight of 800 lbs. is a linear function of time for each calf but varies between calves and lines. Sex of calf influences the slope of the growth curve, with bulls showing a steeper slope than heifers. The slope of the growth curve pre- and postweaning shows only a slight relationship for each calf.

5. Young mice nursing mothers which received injections of testoster one showed no alteration in suckling gains unless the mothers received a quantity which interfered with milk production, in which case growth of the young was decreased. Following weaning and with young receiving no testosterone treatment themselves, the young which had nursed mothers that received testosterone grew at a much more rapid rate than mice which nursed control mothers. At 60 days of age the mice which nursed treated mothers weighed 25 percent more than the mice which nursed control mothers.

The two heifers which are receiving testosterone are continuing to gain and show masculinization similar to bulls. Both were bred but one is apparently not pregnant, and it is not certain that the other one is pregnant.

The blood constituents studied appear to be related to rate and efficiency of gains but no one constituent is valid as a means of predicting accurately the production performance of a calf. A combination of several blood and urine constituents may be found useful in the prediction of future performance of a calf. The level of 17-ketosteriods in the urine is related to the level of blood amino acids, which indicates that the adrenal cortex function reduces rate of gain by reducing protein anabolism or by increasing protein catabolism.

The urine-collecting apparatus which has been developed permits us to collect urine from males or females in pens or on pasture over as long a period as may be desired.

The chromatographic studies reveal that certain amino acids are excreted only by the slow-gaining and inefficient animals.

One poor-doing bull has been found to have a severe heart disturbance which could account for his reduced growth rate.

6. The selection with mice for increased and decreased weights at 45 days of age shows that progress downward is more rapid than that in the increased direction. However, the mice selected for increased size appear to be physiologically normal while those selected for smaller size show increasing physiological disturbances. To establish the basic population from which selection was initiated, crosses of four unrelated strains were made. The crossing of the four strains was done systematically, growth rate and feed consumption being measured for all strains, crosses, and reciprocal crosses. Reproductive performance and efficiency of performance of the F_1 mice were also studied. One cross resulted in mice which show a marked increase in need for folic acid and biotin. This strain cross was quite inferior to the strains used when raised on the stock diet.

7. Correlations of various traits involving body scores and measurements, rate and efficiency of gains, and others, show the following:

   (a) Calves that are born later in the season make lower suckling gains, reach 800 lbs. at an older age, and are smaller in chest width than those born early in the 90-day calving season.

   (b) Heavier calves at birth gain more rapidly during the suckling and feed-test periods, reach 500 and 800 lbs. body weight at younger ages, are more efficient in feed utilization, and score higher for type and conformation at 500 and 800 lbs. body weight than the calves smaller at birth.

   (c) Calves which gain more rapidly during the suckling period reach 500 and 800 lbs. body weight at earlier ages, are smaller in chest depth and heart girth and larger in paunch circumference, and have longer rumps than those which gain more slowly while nursing.

   (d) Older calves at 500 lbs. body weight are the older ones at 800 lbs. body weight, have deeper chests but lack in chest width and paunch circumference, and score lower at 800 lbs. for type and conformation than the calves younger at 500 lbs.

   (e) Calves which are higher at the withers at 500 lbs. are deeper in the chest, and those which are higher at the withers at 800 lbs. are also deeper in the chest, have a larger heart girth, and score lower at 800 lbs. than those with less height at the withers.

   (f) Calves with greater chest depth at 500 lbs. are longer-bodied, larger in heart girth, and those which are deeper in the chest at 800 lbs. are also larger in heart girth and paunch circumference at 800 lbs. than the calves with less chest depth.

   (g) Calves that are wider in the chest at 500 lbs. body weight have a greater heart girth and paunch circumference and less round but longer rumps at 500 lbs. Those wider in the chest at 800 lbs. have a larger heart girth at 800 lbs.

(h) Longer-bodied calves at 500 lbs. are smaller in heart girth and larger in the rump at 500 lbs., make more rapid and efficient gains, have lower height at withers and greater body length at 800 lbs., and score lower at 800 lbs.

(i) Calves with greater heart girth at 500 lbs. have larger paunch circumference and longer rumps at 500 lbs., reach 800 lbs. at an older age, have larger heart girth and smaller rounds at 800 lbs. Those larger in heart girth at 800 lbs. have larger paunch circumference and smaller rounds at 800 lbs.

(j) Calves with greater paunch circumference at 500 lbs. have smaller rounds at 500 lbs.

(k) Calves with larger rounds at 500 lbs. gain more rapidly and efficiently, have smaller heart girths and paunch circumferences and larger rounds at 800 lbs.

(l) Calves with longer rumps at 500 lbs. are more efficient feed users.

(m) Calves which gain more rapidly are more efficient, reach 800 lbs. at a younger age, have less width, height, and heart circumference, and score higher at 800 lbs.

(n) The more efficient animals reach 800 lbs. at a younger age, are lower in wither height, chest depth, and chest width, are longer in body and smaller in heart girth at 800 lbs.

(o) Calves which reach 800 lbs. at the older ages score lower.

(p) Calves that score higher at 500 lbs. score higher at 800 lbs.

8. Data from calves that were fed at different levels of TDN intake each of four years at Squaw Butte warrant the following conclusions:

(a) Rate of gain is closely related to TDN required per unit of gain. This relationship is curvilinear with a markedly higher TDN requirement per unit of gain when the calves are gaining at a low rate when compared with more rapidly gaining calves.

(b) Calves that are more severely restricted in feed intake during the winter make slightly greater gains during the summer grazing period but differ markedly in final weight from the more liberally fed calves. Apparently, the feed conditions on this range are not adequate for calves to recover from a growth retardation caused by restricted TDN the previous winter.

(c) There is some indication that calves within a level of feeding which make more rapid gains during the winter will make more rapid gains during the following summer grazing period.

(d) There is a linear relationship between TDN intake and rate of gain, with calves that receive more feed gaining more rapidly. It appears that an intake of 10 lbs. TDN per day is needed for a gain of 2 lbs. per day.

(e) Feed efficiency is linearly related to TDN intake, with calves that are receiving more feed making more efficient gains.

9. The calves which were feed tested in 1954-55 showed considerable variation in rate and efficiency, but generally were very outstanding, showing continued improvement. The David line showed some deficiency in suckling gains and scores. The calves fed in 1955-56 showed the greatest suckling gains ever obtained at the Oregon Station, and the David line showed marked improvement in score. Rate of gain and feed efficiency were the least variable since the lines were started, and showed no improvement over the year before. All calves born in 1956 have been normal with the exception of one Angus which shows eye defects. This, apparently, is associated with a higher vitamin A requirement.

10. There was no association between the animal's ability to digest feed and its rate and efficiency of gains.

VI. Work Planned for the Future:

Outlook:

When does the change in the growth to the fattening phase of development occur and what is the relation of the change in the growth pattern to genetically different rates and economics of production?

What is the relation of rate and economy of gain in the feed-lot to the performance of the animals on the range?

What changes in body composition accompany selection for rate and efficiency of gains? It would seem that our primary objective in beef improvement is to produce lean meat rapidly and economically. There is a need for determining body composition in the live animal so that selections can be made for the greater production of protein.

Practical Application of Results or Public Benefits:

Improvement has been made in rate and economy of gains in all four lines in the two generations of cattle covered by the Oregon Station even though inbreeding exceeding that of half-sib matings has been practiced. The progress in rate of gain has been more striking than that in feed efficiency.

The registered line of Herefords at the Eastern Oregon Station has continued to improve in production while being handled under Eastern Oregon range conditions. This, plus the significant regression of economy of gain on rate of gain, indicates that a rancher in Eastern Oregon can improve both rate and efficiency of gain by weighing calves at birth and weaning and selecting accordingly, with very little change in his methods of operation.

The administration of testosterone increased the rate and economy of gains, particularly in heifers. This indicates that with the use of the hormone more beef could be produced with less feed. Two studies are needed, however, to make this practical. One must first know that the hormone in the beef cattle is eliminated prior to slaughter so no harm will come to people eating the meat. The hormone must be administered in a form and way that will require minimum handling of the animals. There is evidence that this hormone increases bone growth and nitrogen and water retention, which means more muscle but reduced fat storage. From the standpoint of present human needs for more protein and less fat, one might see a real place for use of testosterone in the cattle fattening program.

Procedures have been worked out which are being put into practice by ranchers with the help and guidance of the Extension Service that are giving marked improvement in beef cattle production over the state. At present, 50 breeders are doing production testing.

Several of the factors which influence feed-lot or test performance have been studied so that we now know which ones influence performance most and can do all possible to standardize our test program properly as the dairy people have in their dairy herd improvement work. It appears now that the adjustment period of about a month between weaning and feed testing allows the test to be made with the minimum of preinfluence affecting it.

Many practical applications of results may be made of the material that has been put out in published form. One unpublished indication arises from results of the three stations--one using roughage with only a bare amount of concentrate, one using two parts good alfalfa hay to one part of concentrate, and the other using heavy concentrate-to-hay feeding. It appears that selection for the best-doing animal in each group leads to improvement. This shows the fact that selections for good feed-lot performance can be made on a ration which will not be injurious to future production of the bulls and heifers because of overfatness.

Program for the Coming Year: (Proposed procedure for research during the coming fiscal year.)

3. Collect more data so that heritabilities can be determined on parent-offspring regressions as well as by variance partitioning and also so that sufficient data are available for genetic and phenotypic correlations.

4. Analyze data and develop a mathematical description of growth in beef cattle. Determine the effects of sex, lines, and other factors on the growth curve of beef cattle.

5. Determine the normal physiology of the beef animal, such as respiration rate, heart rate, blood pressure, and some other physiological characteristics, and see if age, season, and sex influence them. Determine from figures already obtained if these physiological functions are closely related to rate and economy of gains.

Continue injecting two heifers with testosterone and attempt to breed them. Continue observations on growth rate, development, and behavior.

Determine the influence of testosterone injections into lactating rabbits, guinea pigs, rats, and cattle, on the growth rate of their young during and following the nursing period.

Make chromatograms of urine from all calves in the four lines at 500 and 800 lbs. body weight.

Collect blood from all cows losing calves at birth or soon after and test the blood for presence of erythrocyte antibodies.

Determine body composition in the live animals by use of heavy water and determine the relation of body composition to such productive traits as rate and efficiency of gains and score. Also, determine the factors which influence body composition.

Continue the study of protein-bound iodine in relation to rate and efficiency of gains. Determine electrophoresis of blood plasma as a means of separating the proteins to determine if cattle which do well have a capacity for efficiently assimilating certain materials which are needed for growth.

Obtain EKG records on certain animals in each line to determine if heart function may be associated with outstandingly good or poor performance.

Continue the study of rabbit growth and feed efficiency where pre- and postnatal environments are held constant and genetics vary. Also, study prenatal growth of rabbits under these conditions.

6. Continue the work on the use of rabbits and other laboratory animals as pilot animals in various genetic and physiology studies that may later be applied to beef cattle improvement.

Continue the development of five lines of mice, two with selection for large body weight at 45 days of age, two with selection for small body weight at 45 days of age, and one with no selection. Selection in one of the large lines and one of the small lines will be for 45-day weight in both sexes. In the other large and the other small line, selection will be for 45-day weight of the females, the males being selected on the basis of the mother's 45-day weight. All mice will be individually fed except when males are in the cages with females and before litters are weaned. All feed consumed will be measured.

Obtain data on OSC cattle and on cattle in other herds where OSC bulls are being used to provide more information on heritability within the herds and general combining ability with other herds.

7. Obtain photographs, scores, and measurements on each calf at 500 lbs., when it goes on feed test, and at 800 lbs. when it comes off feed test in both the Hereford and the Angus herd.

8. The Squaw Butte studies will be under modification. The nucleus herd has been discontinued as a source of breeding stock for the commercial herd because it required most of the desirable female material for replacements within the nucleus herd. Twenty-eight heifers will be individually fed during each of four years; one group of 14 will be given adequate TDN to allow maximum gains while one group of 14 will have TDN intake restricted by feeding roughages and a limited amount of concentrate. All heifers will be retained in the breeding herd and their calves will be feed-tested under a standard full-feeding program to determine if cows with the best performance under each feeding level produce calves with superior performing ability.

9. Individually feed all calves produced in the purebred Hereford and Angus herds, recording rate of gain and feed consumed from 500 to 800 lbs. body weight.

   Cooperate with breeders both as individuals and as groups in keeping records to help in selection and in their feed-testing programs.

   Make matings to continue the three sublines of Herefords and one line of Angus.

   Cooperate to the fullest extent with the branch stations, particularly in the analysis of data and in the making of breeding material available to them.

10. Complete this phase by publication of material.

VII. Publications and Manuscripts:

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_____, G. E. Nelms, R. W. Mason, D. A. Price, C. E. Shelby, and R. T. Clark. 1955. Body measurements, scores, gains, and feed efficiency of growing beef cattle. (Abs.) J. Anim. Sci. 14:1175.

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Mason, R. W., Ralph Bogart, and Hugo Krueger. 1956. Relationship of suffocation time to rate of gain, food intake, and thyroid weight in male mice from strain crosses. (Abs.) Oreg. Acad. Sci. Proc.

Nelms, G. E., and Ralph Bogart. 1955. The effect of birth weight, age of dam, and time of birth on suckling gains of beef calves. (Abs.) J. Anim. Sci. 14:1187.

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Nelms, G. E., D. A. Price, and Ralph Bogart. 1955. The relationships of some digestion coefficients to rate and efficiency of gains in growing beef cattle. Western Section, Amer. Soc. Anim. Prod. Proc. 6:217-222.

_____. 1956. Urinary 17-ketosteroids, rate of gain, feed efficiency, and certain blood constituents of beef cattle. Ph. D. Thesis. Oregon State College.

Nicholson, Hugh H., R. W. Mason, John Kaufmes, Ralph Bogart, and Hugo Krueger. 1956. The effects of injected testosterone into lactating mice on the suckling gains of their offspring. (Abs.) Oreg. Acad. Sci. Proc.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State Oregon
Date 6/19/56

Line designation	Lionheart	Prince	David	Angus
Breed	Hereford	Hereford	Hereford	Angus
Station	College	College	College	College
Bulls (12 mo. or over)	6	6	6	6
Cows (2 yrs. or over)	17	15	14	19
Heifers, yearlings	3	3	5	6
Bull calves	6	6	6	7
Heifer calves	2	6	6	14
Percentage use for breeding project	75%	75%	75%	75%
Estimated cash value	$10,100	$9,900	$8,200	$10,900

(2) Grades

Line designation	Crow	Chandler		
Breed	Hereford	Hereford		
Station	Squaw Butte	Union		
Bulls (12 mo. or over)	2	2		
Cows (2 yrs. or over)	30	30		
Male calves	12	13		
Heifer calves	13	13		
Percentage use for breeding project	100%	25%		
Estimated cash value	$ 6,000.00	$6,000.00		

b. Young animals on feed 82 .
(1) Purebreds

	Hereford		Angus	
	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	22	-	8	-
Heifers	13	-	11	-

(2) Grades

Bulls				
Heifers	28			

c. Additional land, physical facilities and equipment used .

Item	No.	Actual Cash Value	Percentage use for beef breeding project
Feed storage bins	2	$ 700.00	100%
Trailer scale	1	$ 600.00	25%
Monroe-matic calculator	1	$ 910.00	100%
Trailer	1	$1,000.00	25%
Loading chute	1	$ 300.00	25%

d. Cow production data 1955 calves.

Breed	Hereford	Hereford	Hereford	Angus
Line	Lionheart	Prince	David	
No. cows bred	18*	17**	18***	28****
No. calves born	12	15	15	24
(a) alive	11	14	12	19
(b) dead	1	1	3	5
(c) total	12	15	15	24
No. calves weaned	11	14	12	19
Percent calf crop				
(a) birth	66.67	88.24	83.33	85.71
(b) weaning	61.11	82.35	66.67	67.86

* Includes 4 yearling heifers
** Includes 2 yearling heifers
*** Includes 4 yearling heifers
**** Includes 4 yearling heifers

Average	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
1. Birth wt.	5	72.5			5	72.8	9	73.3			4	72.0	8	70.0			4	62.5	8	64.9			11	56.4
2. Weaning age																								
3. Weaning wt.																								
4. Weaning wt. (Suckling gains (Adj. ___ days)	(adj) 1.80				1.64		1.87				1.76		1.61				1.45		1.90				1.79	
5. Wean. score																								
(a) Cond.*		9.9				10.0		10.1				8.3		8.9				8.2		9.2				9.5
(b) Conf.*		11.8				11.2		10.5				9.3		9.1				7.9		9.5				9.3

* ranges from 5 to 15.

e. Feed-lot performance 1955-56 .

Breed	Hereford		Hereford		Hereford		Angus	
Line	Lionheart		Prince		David		Angus	
Sex	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers
No. on test	5	5	9	4	8	4	8	11
Average:								
Age on test	213	236	217	217	248	285	207	225
Initial weight	500	500	500	500	500	500	500	500
Initial score								
(a) Cond.	9.9	10.0	10.1	8.3	8.9	8.2	9.2	9.5
(b) Conf.	11.8	11.2	10.5	9.3	8.1	7.9	9.5	9.3
Days on test	113	152	116	147	103	133	124	153
Gain								
(a) Total	300	300	300	300	300	300	300	300
(b) Average	2.65	1.97	2.59	2.04	2.91	2.26	2.42	1.96
Efficiency of feed utilization								
(a) #TDN/100# gain	454	587	429	525	407	580	508	617
Final weight	800	800	800	800	800	800	800	800
Final score								
(a) Cond.	10.9	12.6	11.1	11.5	11.1	Not scored yet	10.4	11.9
(b) Conf.	12.2	13.8	11.4	12.6	11.0		10.7	11.7

f. Phenotypic classification of calves arranged by profile type and by breeding tests of sires and dams.

Proven carrier cows None .

Daughters of proven carrier bulls None .

We used only profiled clean bulls. No dwarf or stillborn calves were produced.

U. S. Range Livestock Experiment Station

I. Station: U. S. Range Livestock Experiment Station, Miles City, Montana.

II. Project Titles:
APH dl-1 Rev. The development and testing of methods of measuring performance in beef cattle.
APH dl-2 Rev. Development of superior lines of beef cattle.

III. Personnel: J. R. Quesenberry, R. R. Woodward, F. J. Rice, C. E. Shelby, and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year:

1. 1955-56 R.O.P. Bulls--As in 1954-55, the selected male progeny of 14 sires were tested. Nine lines and one crossline mating were represented in the test. Average daily gains between sire groups ranged from 2.72 pounds per day to 2.18 pounds, and final weights from 1013.3 pounds to 781 pounds. The fastest gains were registered by the Line 11 bulls (a Line 1 x 5 cross, back crossed to Line 1.)

2. 1955-56 Progeny test--Sires of the steer calves this year are as follows: T1, T2 and T3--Line 1; T4--Line 4; T5--Line 5; T6--Line 6, and T7--Line 13. Steers sired by the Line 13 bull (Brae Arden) have gained .10 pound per day less than the next lowest sire group. Inasmuch as the dams of these steers were all unrelated to the L13 sire, their record to date has been quite disappointing. Extra steers, where available, are being fed in the progeny groups. More critical carcass analyses, including tenderness, palatability and cut-out values, will be obtained from these steers in July.

3. 1955-56 Calf production--The 1955 weaning weights were slightly lower than in 1954, probably due to above normal temperatures and below normal precipitation during the latter half of the suckling period. Calving percentages in 1956 were relatively high, however, except for the Brae Arden line in which only 33 percent of the cows calved.

4. A study of various factors influencing the growth and production of range cattle was completed and will be published in the near future. Included were growth data on 7,436 Hereford calves from 2,131 cows covering the period 1926 to 1953, inclusive. The following characteristics were studied: birth weight, weaning weight, gain from birth to weaning, previous fall weight of the cow, spring weight of the cow and fall weight of the cow. Adjustments were computed for sex and age of dam differences for range cattle operated under similar conditions. There was found to be a threshold of 4 to 6 inches for growing season precipitation above which there was little increase in growth from birth to weaning.

5. For the past three years the station has been collecting data on stillborn calves occurring in the station herd. A relatively high incidence of stillbirths appears to be a common problem in the area. Post-mortem findings, vitamin A, phosphorus and calcium levels from blood samples of the dams, skeletal abnormalities, etc., are noted. There has been some evidence that breech and/or posterior presenta-

tions are heritable. The percentage incidence of stillbirths for the entire herd was approximately 6 percent in 1955.

6. An outbreak of frothy bloat, the first experienced in the station herd, occurred shortly after weaning in 1955. Three grade steers sired by an L13 bull and an L10 bull on test died and a number of other calves were affected. Since standard management procedures have been followed for a number of years, the fact that these cattle were supplied by a newly installed soft water well suggested itself as a possible cause.

7. Observations on development of station inbred lines thus far indicate that certain individual cow production records in all lines exceed the means of the most productive line any year. Accordingly, a selection was made in 1955 on the basis of production records in which the highest producing cows (on the basis of pre- and post-weaning calf data) were bred to five top sires representing five lines selected on their performance record. All possible crossline matings were made. This procedure will be followed for two years and the resulting progeny will be the foundation of a new line.

8. Wyoming Cooperation: Since the last report, the immunogenetic laboratory has typed 570 animals of which 398 were from the Miles City herd. There have been 79 males on performance test typed and the remainder have been young females. The former are being used for a study of the possible association of blood type with economic characteristics; the latter are being studied in connection with immunogenetic behavior of inbred lines.

   Head form measurements and profilometer readings on:

   1953 heifers: 95 head measured twice
   1954 heifers: 105 head measured 4 times
   1955 heifers: 125 head measured twice

9. Ohio Cooperation: The progeny of two sires sent to Ohio for the third successive year and compared with steers sired by an outbred bull and from a Nebraska line are currently being fed out. Comparative data to date are listed below:

	Steers			Heifers		
	Montana	Nebraska	Outbred	Montana	Nebraska	Outbred
Birth weight	77.2	73.5	69.4	70.6	70.6	59.9
Weaning weight (182 days)	430	376	375	405	367	355
Weaning score	8.5	7.2	9.2	7.2	7.6	8.7
Average weight 5-15-56	891	822	793	792	778	754
Average daily gain	2.22	2.23	2.11	1.98	2.08	1.89

V. Summary of Progress and Conclusions to Date:

Line 11 bulls have for the fourth consecutive year been superior to all other lines in terms of rate of gain of selected male progeny. They have ranked high in growth during the suckling period and have a very acceptable conformation, at least according to our present standards. This body of evidence lends support to the idea that desirable new lines can be formed by crossline matings and maintained thereafter at levels superior to the parental lines. Undoubtedly, systems of matings following the original foundation will be dependent upon the genetic worth of the parental lines. In the case of Line 11, with a relatively high and an intermediate parental line, backcrossing to the best line has seemed to be most productive. In Line 12 both parental lines are high producing lines. Inter se matings are being used in this line but sufficient time has not yet elapsed to evaluate results.

VI. Work Planned for the Future:

Because of the volume of data that has been collected and analyzed in record of performance studies at various locations, it is now possible for the researcher to make sound recommendations for increased growth and production in beef cattle. There are little available data upon which to make recommendations for meat quality improvement. The progeny tests are being planned to investigate the degree to which tenderness, palatability, lean fat ratios, percentage of the various cuts, etc., can be influenced by breeding. Test herd matings to extremes in beef type will be made to determine quality and cut-out differences.

VII. Publications and Manuscripts:

Koch, R. M., and R. T. Clark. 1955. Genetic and environmental relationships among economic characters in beef cattle: I. Correlation among paternal and maternal half-sibs. J. Anim. Sci. 14:775-785.

_____ and R. T. Clark. 1955. Genetic and environmental relationships among economic characters in beef cattle. II. Correlation between offspring and dam and offspring and sire. J. Anim. Sci. 14:786-791.

_____ and R. T. Clark. 1955. Genetic and environmental relationships among economic characters in beef cattle. III. Evaluating maternal environment. J. Anim. Sci. 14:979-996.

Stroble, C. P., and N. W. Hilston. 1955. A study of the possible association of blood groups and feeding performance of beef cattle. Western Section, Amer. Soc. Anim. Prod. Proc. 6:57.

Woodward, R. R. 1955. Growth of cattle under eastern Montana conditions. Beef Production School, Montana State College. Mimeo. C. December 1955.

_____ 1955. Here's where we stand on crossbred beef. Successful Farming 53(12):49,100.

_____ 1956. A study of vaginal and uterine prolapse in Hereford cattle. J. Anim. Sci. 15:119-124.

a. Cattle Inventory
(1) Purebreds

PROJECT SUMMARY
Fiscal Year 1956

State Montana
Date May 1, 1956

Line designation	1	4	5	6	8	9	10	11	12	13
Breed	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford
Station	U. S. Range Station									
Bulls (12 mo. or over)	40	16	7	11	7	9	10	3	8	5
Cows (2 yrs. or over)	202	53	45	37	27	50	32	26	17	23
Heifers, yearlings	45	12	8	12	8	14	12	10	6	6
Bull calves	72	21	10	6	5	13	13	9	6	2
Heifer calves	47	17	6	8	6	25	5	7	9	4
Percentage use for breeding project										
Estimated cash value										

(2) Grades

Line designation										
Breed	Hereford									
Station	U. S. Range Station									
Bulls (12 mo. or over)	None									
Cows (2 yrs. or over)	322									
Heifers, yearlings Male calves	107 107									
Heifer calves	93									
Percentage use for breeding project										
Estimated cash value										

b. Young animals on feed 129 .
(1) Purebreds

	Herefords		Angus		Shorthorns	
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	79					
Heifers						
Steers						
(2) Grades						
Bulls						
Heifers						
Steers		50				

c. Land, physical facilities and equipment used .

Item	No.	Actual Cash Value	Percentage use for beef breeding project	
Land	56,000 acres	$ 812,500.00	92 percent	
Buildings, corrals, land				
improvements, fence,				
residences, etc.		$2,500,000.00	92 percent	

d. Cow production data _____ calves.

Breed	Hereford	Hereford	Hereford	Hereford
Line	1	4	5	6
No cows bred	151*	44*	31*	28*
No calves born				
(a) alive	107	30	20	24
(b) dead	10	3	2	1
(c) total	117	33	22	25
No calves weaned	105	29	18	24
Percent calf crop				
(a) birth	90.7*	91.7*	84.6*	92.6*
(b) weaning	81.4	80.6	69.2	88.9

*22 cows sold after breeding season; percentage calf crop figured on 129 cows

*8 cows sold after breeding season; percentage calf crop figured on 36 cows.

*5 cows sold after breeding season; percentage calf crop figured on 26 cows.

*1 cow sold after breeding season; percentage calf crop fig. on 27 c

	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heife	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	A
Average:																								
1. Birth wt.	35	83.9	24	81.1	46	78.8	11	82.6	6	76.8	12	79.6	4	77.8	6	75.2	8	76.3	9	68.0	3	72.0	12	63.
2. Weaning age		179.4		176.1		180.5		178.5		189.2		182.8		180.3		165.7		174.9		184.7		168.3		177.3
3. Weaning wt.	35	461.9	24	412.0	46	422.6	11	397.7	6	395.5	12	380.34		457.3	6	360.0	8	370.8	9	437.0	3	405.0	12	371.8
4. Weaning wt. (adj. ___ days)		452.7		419.5		420.3		401.5		380.3		374.8		456.3		383.7		377.0		427.9		426.3		376.3
5. Wean. score																								
(a) Cond.																								
Combined	35	7.9	24	7.2	46	7.7	11	7.6	6	7.3	12	7.6	4	7.8	6	7.3	8	7.7	9	7.9	3	7.5	12	7.8
(b) Conf.																								

d. Cow production data _____ calves.

Breed	Hereford			Hereford			Hereford				Hereford					
Line	8			9			10				11					
No. cows bred	18			34*			31*				19					
No. calves born																
(a) alive	16			25			21				18					
(b) dead	0			1			6				0					
(c) total	16			26			27				18					
No. calves weaned	15			25			21				18					
Percent calf crop																
(a) birth	88.9			83.9*			90.0*				94.7					
(b) weaning	83.3			80.6			70.0				94.7					
				*3 cows sold after breeding season; percentage calf crop figured on 31 cows.			*1 cow sold after breeding season; percentage calf crop figured on 30 cows.									
	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Average:																		
1. Birth wt.	3	80.3	5	82.2	7	71.0	7	73.0	4	70.0	14	67.6	6	81.2	2	81.0	13	78.6
2. Weaning age	186.3		160.6		182.4		175.7		180.3		175.5		179.0		176.5		173.9	
3. Weaning wt.	3	409.7	5	330.0	7	349.1	7	440.4	4	417.5	14	353.4	6	454.4	2	394.0	13	373.8
4. Weaning wt. (adj. ___ days)	398.3		360.2		345.4		448.9		416.5		364.6		444.0		399.0		385.4	
5. Wean. score																		
(a) Cond.)																		
Combined)	3	7.5	5	6.8	7	7.2	7	7.9	4	7.2	14	7.4	6	7.6	2	6.9	13	7.5
(b) Conf.)																		

	Bulls		Steers		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.
Average:						
1. Birth wt.	3	82.0	4	76.5	11	77.3
2. Weaning age	185.0		181.3		188.5	
3. Weaning wt.	3	453.3	4	323.3	11	427.6
4. Weaning wt. (adj. ___ days)	444.0		325.8		409.2	
5. Wean. score						
(a) Cond.)						
Combined)	3	7.8	4	6.6	11	7.9
(b) Conf.)						

d. Cow production data_____ calves.

Breed	Hereford	Hereford	Hereford Unregistered-grades	
Line	12	13		
No. cows bred	17	17	232	
No. calves born				
(a) alive	12	11	148	
(b) dead	2	0	5	
(c) total	14	11	153	
No. calves weaned	11	9	146	
Percent calf crop				
(a) birth	82.4	64.7	82.7	
(b) weaning	64.7	52.9	78.9	

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	Bulls No. Ave.	Steers No. Ave.	Heifers No. Ave.	Bulls No. Ave.	Steers No. Ave.	Heifers No. Ave.	Bulls No. Ave.	Steers No. Ave.	Heifers No. Ave.	Bulls No. Ave.	Steers No. Ave.	Heifers No. Ave.
Average:												
1. Birth wt.	None	5 83.8	6 80.0	2 67.5	1 78.0	6 72.0	None	77 82.2	69 76.3			
2. Weaning age		187.8	187.2	183.5	179.0	166.5		175.8	175.7			
3. Weaning wt.		5 454.6	6 434.5	2 349.0	1 275.0	6 319.3		77 408.5	69 384.0			
4. Weaning wt. (adj. ___ days)		439.8	420.8	343.5	276.0	337.3		417.0	391.8			
5. Wean. score												
(a) Cond.)												
Combined)		5 7.2	6 7.5	2 6.5	1 5.5	6 6.9		77 7.7	69 7.8			
(b) Conf.)												

e. Feedlot performance Bulls .

Breed	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford
Line	1	4	5	6	8	9	10	11	13
Sex	Male	Male	Male	Male	Male	Male	Male	Male	Male
No. on test	35	11	4	9	3	7	5	3	2
Average:									
Age on test	195.4	159.3	196.3	200.7	202.3	191.7	168.8	201.0	199.5
Initial weight	473.1	409.9	446.0	433.3	415.3	443.1	452.2	480.7	346.0
Initial score	None	None	None	None	None	None	None	None	None
(a) Cond.									
(b) Conf.									
Days on test	196.0	196.0	196.0	196.0	196.0	196.0	196.0	196.0	196.0
Gain									
(a) Total	16266	5036	1886	3854	1294	2979	2451	1598	870
(b) Average	464.7	457.8	471.5	428.2	431.3	425.6	490.2	532.7	435.0
Efficiency of feed utilization									
(a) #TDN/100# gain									
(b) #Gain/100# TDN	21.62	22.66	21.93	21.33	21.61	21.00	23.47	23.28	24.01
Final weight	937.9	867.7	917.5	861.6	846.7	868.7	942.4	1013.3	781.0
Final score									
(a) Cond.	None	None	None	None	None	None	None	None	None
(b) Conf.									

Utah State Agricultural College

I. Station: Utah Agricultural Experiment Station, Logan, Utah.

II. Project Title: The improvement of beef cattle through breeding research.

III. Personnel: James A. Bennett, Doyle J. Matthews, Owen Asplund, A. Jr. Nyman, Gren Owens, and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year: Additional data were collected on performance in the two lines of Hereford and the one Shorthorn line. Individual feeding tests were carried out with 21 of the more promising Hereford and 8 Shorthorn.

One young Hereford bull was again mated with the test herd of 12 cows, each known to have produced a dwarf calf.

Detailed studies were initiated to determine the value of tritium oxide and antipyrene for determination of body composition in live cattle. The tritium oxide studies were conducted in cooperation with the Atomic Energy Commission at Los Alamos, New Mexico. These studies are only partially completed.

In order to learn to what extent the rumen water would affect determinations, three fistulated steers were used in the study.

The possibility of identifying genotypes in cattle in connection with the dwarf gene by biochemical means was explored again this year. Detailed study of the so-called "fourteen" spot was made. The "fourteen" spot was found to be made up of several compounds. Methods were developed by which it was possible to separate this compound into several of its components. The compound that seemed to have some promise for identifying cattle genotypes was carefully studied. Much was learned concerning its characteristics, but it has not yet been definitely identified. It is, apparently, a substance that has not been previously studied or reported in the literature.

V. Summary of Progress and Conclusions to Date:

The analyses of data showed that significant differences existed between sire-offspring groups for rate of gain, efficiency of gain, and final feed-lot weight.

The sex influence upon performance on test in feed-lot was pronounced. Bull calves gained 0.66 pound more per day, gained 4.63 pounds more for each 100 pounds of TDN consumed, and were 113 pounds heavier than heifer calves when both were fed on a time-constant system.

Weight of calf at the start of the feeding test did not influence rate of gain, but had a definite influence on efficiency of gain.

Age of dam did not influence rate of gain, efficiency of gain, or final feedlot weight when proper adjustments were made for sire, sex, and initial weight.

The value of paper chromatography and microbiological assay for identifying genotypes in relation to the dwarf condition in cattle was explored. Some differences in chromatograms did appear. One area designated as the "fourteen" spot showed some promise of differentiating carrier and non-carrier bulls. The difference appeared to be largely quantitative rather than qualitative. Microbiological assays showed that dwarf animals excrete higher levels of glutamic acid in the urine than do normal animals.

VI. Work Planned for the Future:

1. Continue the development of two lines of Herefords and one line of Shorthorns by selection on bases of performance.

2. Continue studies with tritium oxide and antipyrene to fully evaluate these substances for estimating body composition of live cattle.

3. Continue chromatographic and microbiological studies with the various genotypes in regard to the dwarf gene.

4. Analyze the data now on hand in detail for the purpose of developing more effective selection methods.

VII. Publications and Manuscripts:

Asplund, Russell Owen. 1955. The application of some biochemical methods to a study of the different genotypes associated with dwarfism in Hereford cattle. M. S. Thesis. Utah State Agricultural College.

Bennett, James A., and Doyle J. Matthews. 1955. Performance testing studies with beef cattle. Utah Agr. Expt. Sta. B. 377.

_____ 1955. Performance testing of beef cattle. Utah Farmer. November 1955.

PROJECT SUMMARY
Fiscal Year 1955

a. Cattle Inventory
(1) Purebreds

State Utah
Date May 1, 1956

Line designation				
Breed	Hereford	Hereford	Shorthorn	
Station	Panquitch	Logan	Logan	
Bulls (12 mo. or over)	12	7	8	
Cows (2 yrs. or over)	47	28	28	
Heifers, yearlings	12	4	2	
Bull calves	16	14	11	
Heifer calves	17	6	11	
Percentage use for breeding project	100	85	85	
Estimated cash value	$14,160	$8,100	$8,140	

b. Young animals on feed 1955-56 .
(1) Purebreds

	Herefords		Shorthorns		
	Number individually fed	Number group fed	Number individually fed	Number group fed	
Bulls	17		6		
Heifers	4	12	4		
Steers	0		0		

(2) Grades

Bulls	1		
Heifers	1		
Steers	0		

c. Land, physical facilities and equipment used_____.

Item	No.	Actual Cash Value	Percentage use for beef breeding project
Land - Panquitch	155 acres	$31,000.00	90%
Land - Logan	269 acres	80,000.00	90%
Sheds, yards, equipment	4 units	50,000.00	100%
Metabolism building	1	35,000.00	10%

d. Cow production data 1955 calves.

Breed	Hereford	Hereford	Shorthorn									
Line	Panquitch	Logan	Logan									
No. cows bred	43	26	33									
No. calves born												
(a) alive	42	22	26									
(b) dead	0	1	4									
(c) total	42	23	30									
No. calves weaned	38	22	28									
Percent calf crop												
(a) birth	97.7	88.5	90.9									
(b) weaning	88.4	84.6	84.8									

Average	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
1. Birth wt.																								
2. Weaning age	219				234		184		198				211				223							
3. Weaning wt.	397				357		365		386				455				419							
4. Weaning wt. (Adj. 190 days)	384						398		416				452				437							
5. Weaning score																								
(a) Cond.	2.2				2.1		2.7				2.4		2.0				1.9							
(b) Conf.	1.9				2.0		2.0				2.0		2.0				2.0							

e. Feed-lot performance 1955-56 .

Breed	Hereford	Hereford	Shorthorn
Line	Panquitch	Logan	Bulls
Sex	Bulls	Bulls	Bulls
No. on test	12	3	5
Average:			
Age on test	266.58	258	263.3
Initial weight	490.0	449.33	548.4
Initial score			
(a) Cond.	3	3	3
(b) Conf.	1.7	2.2	1.7
Days on test	168	168	168
Gain			
(a) Total	380.5	348.66	356.2
(b) Average	2.26	2.07	2.11
Efficiency of feed utilization			
(a) #TDN/100# gain			
or (b) #Gain/100# TDN	23.642	23.363	21.244
Final weight	870.5	789	904.6
Final score	2	2	2
(a) Cond.	1.5	2.0	1.7
(b) Conf.			

State College of Washington

I. Station: Washington Agricultural Experiment Station, Pullman and Prosser, Washington.

II. Project Title: The improvement of beef cattle by selection and mild inbreeding within lines of the Hereford, Angus, and Shorthorn breeds.

III. Personnel: S. H. Fowler, M. E. Ensminger, R. D. Setzler, and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year:

1. Production Testing WSC Beef Cattle
Eighteen heifers, 10 bulls, and 12 steers completed a feeding trial. The animals were individually fed on a non-pelleted ration from weaning for a period of 161 days.

2. Bull Testing Program by Counties
Eighteen bulls completed an 150-day individual feeding test at Colfax.

3. Individual Testing Programs
Individual testing programs were carried out by different producers, both purebred and commercial. Each producer kept records on production of his cattle. There were over 75 cooperators in this program.

4. Identifying characteristics of Economic Importance at an Early Age
Relationship between hormone activity and performance in beef cattle.

a. Protein-bound iodine levels in blood. Blood samples were taken from animals on test. PBI determinations were made to find the relationship with the rates of gain.

b. Radio iodine. Two trials were carried out at three months' interval during the course of the feeding test. At each trial the bulls and steers were given 100 microcuries of I^{131} each. Daily monitoring of the thyroid gland was made for two weeks to determine the maximum uptake of I^{131} in the thyroid gland, and the effective half-life of I^{131} in each animal. In addition, total urine was collected from each animal for 24-hour period following administration of I^{131} for determination of I^{131} excretion in urine.

V. Summary of Progress and Conclusions to Date:

1. Production Testing WSC Beef Cattle. The summary of the performance of 40 animals on 161-day individual feeding test is given in the following table:

Summary of Ages, Initial Weights, Average Daily Gains and Feed Efficiency of WSC Beef Calves on 161-day Test

No. of Animals	Birth Weight (lb.)	Ave. Age Begin.Test (days)	Ave. Wt. Begin.Test (lb.)	Ave.Daily Gain (lb.)	Lbs.Feed per 100 lbs.Gain (lb.)
3 Angus bulls	60.7	254.7	540.3	2.27	678.8
5 Hereford bulls	69.0	242.6	495.6	2.73	500.0
2 Shorthorn bulls	75.0	224.0	456.5	2.12	688.7
10 bulls	67.7	242.5	501.2	2.47	591.3
4 Angus steers	63.5	249.0	475.8	1.89	840.5
5 Hereford steers	70.0	239.6	450.2	2.20	664.8
3 Shorthorn steers	76.3	237.3	454.3	2.11	713.9
12 steers	69.4	242.2	459.8	2.07	735.7
10 Angus heifers	57.8	236.0	390.8	1.55	839.3
4 Hereford heifers	71.3	246.3	475.8	1.76	793.7
4 Shorthorn heifers	61.5	256.7	450.0	1.92	775.2
18 heifers	61.6	242.9	422.8	1.68	814.9

2. Bull Testing Program in the County. The results of 18 bulls on 150-day individual feeding test in Whitman County Bull Testing Program is summarized in the following table:

Summary of Performance of Whitman County Bulls on 150-day Feed Test

No. of Animals	Ave. Age Begin Test (days)	Ave. Wt. Begin.Test (lb.)	Ave. Daily Gain (lb.)	Lbs. Feed per 100 lbs. gain (lb.)
6 Angus	223.5	470.3	2.31	668.2
8 Hereford	230.3	562.0	2.64	659.8
4 Shorthorn	216.3	502.3	2.69	641.8
18 bulls	225.4	518.2	2.54	658.6

3. Individual Production Testing Program. Over 75 breeders throughout the state are keeping production records on their animals, in cooperation with the county agent. The calves are weighed and graded at weaning time under the direct supervision of the county agent. The animals are placed on group feeding test, using a ration of breeder's choice. The calves are again weighed and graded individually after a feeding period of about five months. The gains and grades are used in selecting the animals for breeding or sales. If desired, the county agent will certify the gains and grades on individual animals tested.

4. Identifying Characteristics of Economic Importance at an Early Age. Relationship between hormone activity and performance in beef cattle.

   a. Protein-bound iodine. PBI determinations have been completed, and the results are being summarized. These will be available for presentation at the annual meeting.

   b. Radio iodine. First Trial (Feb. 7). The results are summarized in the following table:

Average Maximum Uptake in the Thyroid, Effective Half-Life, and 24-Hour Urinary Excretion of I^{131}.

	No. of Animals	Radioiodine		
		Maximum uptake in thyroid (counts per minute)	Effective half-life (days)	24-hour urinary excretion (mc)
Slow Gainers (Less than 2.3 lb./day)	10	1174	8.5	22.0
Fast Gainers (More than 2.3 lb./day)	9	933	7.3	25.4

Second Trial (May 12). The results are being summarized and will be available for presentation at the annual meeting.

VI. Work Planned for the Future: Production testing will be continued using mild inbreeding systems for selection. Further work will be done with radio iodine, as a means of identifying rapid and efficient gainers.

In cooperation with the Extension Service, Production Testing Programs will be carried out on individual ranches.

VII. Publications and Manuscripts;

Galgan, M. W. 1955. Bovine dwarfism. Wash. State Col. Dept. Anim. Husb. Stockmen's Handb. 1955

_____ and M. E. Ensminger. 1956. Raising beef calves from birth on synthetic and whole dried milk, with and without oxytetracycline. Wash. Agr. Expt. Sta. Sci. Paper 1464. J. Anim. Sci. (in press).

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Ham, W. E., and M. W. Galgan. 1956. Blood levels of protein-bound iodine in beef calves. (Ms. prepared.)

Whitman County Cattlemen's Association. 1956. Results of 1955-56 Whitman County beef cattle production testing of beef bull calves. Whitman County C. No. 4. April 7, 1956.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory
(1) Purebreds

State Washington
Date June 6, 1956

Line designation	1	2	3
Breed	Aberdeen-Angus	Hereford	Shorthorn
Station	Pullman	Pullman	Pullman
Bulls (12 mo. or over)	6	4	3
Cows (2 yrs. or over)	31	15	22
Heifers, yearlings	9	4	4
Bull calves	12	8	6
Heifer calves	12	6	5
Percentage use for breeding project	100%	100%	100%
Estimated cash value	$28,300	$13,725	$16,250

b. Young animals on feed 1955-56 .
(1) Purebreds

	Hereford	Angus	Shorthorn
	Number individually fed	Number individually fed	Number individually fed
Bulls	5	3	2
Heifers	4	10	4
Steers	5	4	3

c. Land, physical facilities and equipment used 1955-56 .

	No.	Actual Cash Value	Percentage use for beef breeding project	
Toledo scale	1	$1,250.00	100%	Land
Bull shelter	1	1,500.00	100%	transferred
Pasture	102 acres	35,700.00	50%	from WSC
Paving feed area in Wintering Quarter		3,500.00	100%	Dept. of Agronomy

d. Cow production data 1955 calves.

Breed	Angus	Hereford	Shorthorn		
Line	1	2	3		
No. cows bred	24	20	18		
No. calves born					
(a) alive	20	14	16		
(b) dead	3	0	0		
(c) total	23	14	16		
No. calves weaned	20	14	11		
Percent calf crop					
(a) birth	90.9	70.0	88.9		
(b) weaning:	90.9	70.0	61.0		

Average	Bulls		Steers		Heifers		Bulls		Steers		Heifers		Bulls		Steers		Heifers					
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.				
1. Birth wt.	3	60.7	5	62.2	12	58.3	5	69.0	5	70.0	4	71.3	6	64.3	4	73.8	6	61.2				
2. Weaning age		254.7		247.6		236.9		242.6		239.6		246.3		225.7		240.5		256.7				
3. Weaning wt.	3	540.3	5	485.4	12	395.1	5	495.6	5	450.2	4	475.8	3	451.0	4	461.8	4	450.0				

e. Feed lot performance 1955-56 .

(See Table in V).

Report on Possible Use of Radioiodine in Identifying Rapid Gaining Beef Animals [1, 2, 4]

By M. W. Galgan, W. E. Ham, and M. E. Ensminger [3]
Department of Animal Husbandry
State College of Washington
Pullman, Washington

The use of radioiodine as a tool in Production Testing of beef animals is based on the assumption that the thyroid gland and the kidneys are the only competitors for iodine. Most of a dose of radioiodine is either collected by the thyroid gland or is excreted in the urine (Owen, et al., 1955 and Chapman and Maloof, 1955). The portion that is taken by the thyroid is used to form thyroid hormone which is absolutely necessary for the normal growth and development of young animals, and for maintaining the normal level of metabolism of animals of all ages. The action of the thyroid may be estimated by the maximum uptake of radioiodine by the thyroid (Keating, et al., 1949; Rugh, 1951; and Nodler, et al., 1954). The uptake of iodine by the thyroid as measured with I^{131} is merely a measure of avidity of the thyroid gland for iodine, and this may be related with the performance of the animal in its ability to gain rapidly. The use of urinary excretion of radioiodine as an indication of the animal's performance is based on the assumption that the urinary excretion reflects the functional state of the thyroid.

The trial reported in this paper was designed to study the relationship between the gains made by the beef animals and their thyroid activity as shown by the thyroid uptake and the urinary excretion of radioiodine.

Experimental Procedure

Twenty-one yearling steers and bulls were used in this study. These animals were on a feeding test, involving measurement for the rate of gain. Radioiodine was administered orally in pellet form (100 microcuries of I^{131} per animal) once during the trial, February 7, and once at the end of the trial, May 11.

Thyroidal uptake of I^{131} was determined by measuring the amount in the thyroid region of the neck at 24-hour intervals for a period of 15 days. The Nuclear Rate Meter with a Geiger-Muller probe was used to measure the thyroid activity.

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[1] In cooperation with the Biology Section, Radiobiological Sciences Department, General Electric Company, Richland, Washington (Dr. L. K. Bustad).

[2] Project 788, Western Regional Project W-1, "The Improvement of Beef Cattle Through Breeding Research."

[3] Assistant Animal Husbandman, Assoc. An. Husbandman and Chairman, Department of Animal Husbandry, respectively.

[4] Acknowledgment is made to Mr. D. E. Foster, Beef Cattle Herdsman, and Mr. James Hayden, Student Assistant, for assistance in carrying the experiment, and Dr. H. M. Reisenauer, Associate Soil Scientist, for use of facilities in measuring I^{131} in urine.

Total urine was collected from each animal for 24 hours after administration of I^{131}. Aliquots of 100 ml. were taken from each, and were counted in a well counter adapted for the Nuclear Scaler. Samples were compared with a standard containing a known amount of I^{131} in 100 ml. of urine.

The thyroidal secretion rate was determined by calculating the effective half-life of thyroidal radioiodine (Albert, 1951). The 24-hour observations over the thyroid area in counts per minute for a period of 15 days were plotted on semi-log paper. A straight line was fitted from which the proportional rate of decline of thyroidal I^{131} was computed.

Results and Discussion

The average daily gain for the twenty-one animals on test for 161 days was 2.24 pounds. The averages for the maximum thyroid uptake, effective half-life, and the 24-hour urinary excretion of I^{131} are given in table 1. There was wide variation among the individual animals with regard to each of the criteria used. On the other hand, the variation in the daily gains was not as high.

Table 1

Average Maximum Uptake in Thyroid, Effective Half-Life, and 24-Hour Urinary Excretion of I^{131} by Periods

Period	Maximum uptake in thyroid (Counts/minute)	Effective half-life (days)	24-hour urinary excretion (microcuries)
February 7	1,059.7	8.2	-
May 11	881.9	6.4	11.5

The correlations between the average daily gain and the different criteria are given in Table 2.

Table 2

Correlations Between Gain and Maximum Uptake in Thyroid, Effective Half-Life, and 24-hour Urinary Excretion of I^{131} by Periods

Item	Correlations	
	February 7	May 11
Thyroidal uptake	-0.401	-0.375
Effective half-life	-0.096	-0.131
Urinary excretion	-	0.214

The relationship between the gains and the thyroidal uptake indicated that the faster gaining animals had a lower uptake of iodine by the thyroid. The faster gaining animals excreted higher amounts of radioiodine during the first 24-hour period.

Summary and Conclusions

Twenty-one beef bulls and steers on test were used to study the possibility of a shorter method in identifying the rapid gainers. Based on this study, the following conclusions appear to be in order:

1. The lower gains in beef animals appear to be associated with the higher uptake of iodine in the thyroid.
2. The higher gains in beef animals appear to be associated with the higher excretion of iodine in the urine.

Further work is required to refine the techniques used in measuring the thyroid uptake and the urinary excretion of radioiodine before it will be possible to use this as a means of identifying the rapid and efficient gainers. This method, however, does show promise as a possible short cut in Production Testing beef cattle.

Literature Cited

Albert, A. 1951. The in vivo determination of the biological decay of thyroidal radioiodine. Endocrin. 48:334.

Chapman, E. M., and F. Maloof. 1955. The use of radioactive iodine in the diagnosis and treatment of hyperthyroidism. The years' experience. Medicine 34:261:.

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Nodler, N. J., C. P. Leblond, and R. Bogoroch. 1954. The rate of iodine metabolism by the thyroid follicle as a function of its size. Endocrin. 4:154.

Owen, C. A., Jr., W. M. McConahey, F. R. Keating, Jr., and A. L. Orvis. 1955. Investigation of diseases of the thyroid gland by means of radioactive iodine. Fed. Proc. 14:723.

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University of Wyoming

I. Station: Wyoming Agricultural Experiment Station, Laramie, Wyoming. Gillette Experiment Station, Gillette, Wyoming.

II. Project Title: Improvement of beef cattle through the application of breeding research.

III. Personnel: P. O. Stratton, N. W. Hilston, C. P. Stroble, C. O. Schoonover (also permanent and temporary farm laborers and graduate students), and R. T. Clark, Coordinator.

IV. Nature and Extent of Work Done This Year and Summary of Progress: Performance data as called for in the project were collected. Birth weights and vigor score at birth were obtained. The calves were weaned at approximately 180 days of age, at which time they were weighed, scored, photographed, measured, and profiled. After a one week adjustment, all weaned calves were put on feed test. The bull calves were individually fed and the heifer calves group fed by sire group for an 168-day feed period. At the close of the feed test, the same data were collected on all individuals as had been obtained at weaning. In addition, the individuals were bled and blood typed. A summary of these performance data is given in Tables d. and e.

The cows were successfully wintered on barley and oat silage and a small amount of alfalfa hay. There was no ill effect noticed at calving from the heavy feeding of silage. Two years ago we initiated the practice of vaccinating the cows with Clostridium perfringens, Type C Bacterin, to help prevent scours in the calves. Although there were no controls, it did appear to aid in a reduced incidence of scours.

The calves from the inbred X inbred matings averaged more at birth (5 lbs.), weaned at approximately the same weight, but gained .38 pound per head per day faster on postweaning feed test than the contemporary calves from the inbred X outbred matings (N=6 and 11, respectively).

The fixed ration was fed loose to those animals on test at the Laramie station and pellet fed to those animals at Gillette. Those animals fed pellets were more efficient but there was considerable difficulty with bloat, especially in the bulls which were individually fed. Of the eleven head slaughtered at the close of the feeding trial, ten head had abcessed livers. This problem will be investigated thoroughly and studied by using various levels of the ingredients in the ration and, in addition, feeding hi-amine to some individuals. The following table summarizes this loose vs. pelleted feeding:

		Av. Daily Gain	Range	Ave.# TDN/ 100# gain	Range
Loose	Males	2.06	2.50-1.65	473#	371#-520#
	Females	1.76	2.32-1.39	505#	
Pellets	Males	2.02	2.54-1.32	354#	269#-440#
	Females	1.81	2.54-1.36	457#	

At the close of the feed test, representative animals from all lines and breeds were slaughtered at the meats laboratory in Laramie. Three years' data are summarized in Table I. These data will be analyzed more completely in an attempt to devise selection criteria for carcass merit.

Table I. Summary Carcass Data by Breed 1953-55 .

Breed	Station	Sex	No.	Mean slaughter Age (Days)	Mean Shrunk Live Wt. (#)	Mean Dressing Percent	Mean Length Body (Cm)	Mean Length Leg (Cm)	Mean Length Loin (Cm)	Mean Ant. Width of Round (Cm)	Mean Area of Eye (Sq. in.)
Here-fords	Laramie	M	23	360	757	57.3	108	68.5	57.0	20.8	10.3
		F	12	353	548	57.4	101	63.7	55.4	18.6	7.7
	Gillette	M	23	374	648	56.7	104	66.1	54.9	19.9	8.9
		F	6	384	490	55.6	99	62.9	54.0	17.6	7.2
Angus	Laramie	M	10	372	638	58.0	104	64.2	54.0	19.7	9.7
Short-horn	Laramie	M	8	349	660	56.5	106	64.8	55.3	20.3	8.1
		F	3	376	523	58.4	100	60.9	53.5	19.5	4.3

Considerable variation of carcass value within and between breeds and sires is quite evident from this table. Also, some of the rib-eye areas of 12-13 month old bulls compared favorably to the rib-eye areas of steers (nutrition experiments) slaughtered at 24 to 30 months of age. It would appear that muscle growth may approach mature size at a relatively young age. Half-sibs of the slaughtered bulls were steered and will be slaughtered next winter to test this hypothesis.

This year a thesis problem was initiated in an attempt to determine the value of creatinine levels of blood serum as related to carcass composition measures. Blood samples were collected from all available animals on progeny test and feed trials at Laramie. Creatinine was measured colorimetrically in a protein-free filtrate. Early tests indicate the need for improvement of techniques in measurement of creatinine levels. This will be investigated next semester. Carcass data obtained included specific gravity of the rib cut and area of the rib-eye. Preliminary data included tests on yearling bulls and heifers, and on steers two to three years of age.

An analysis of three years' accumulated data of head form measurements of 228 Hereford bulls from the Miles City Range Station to their R.O.P. revealed a high positive correlation of head length with feed-lot performance. The determined genetic correlation of diagnostic points of profiles taken of these bulls at 7 and again at 13 months of age were in the neighborhood of +.70. This will be reported in more detail at the Reno meeting.

To date we have accumulated head form data on the following heifers from the Miles City Range Station: 95 head of 1953 heifers measured twice, 105 head of 1954 heifers measured four times, and 125 head of 1955 heifers measured twice. Similar data have been obtained on females from a cooperating rancher and from all progeny produced at the Laramie and Gillette stations. These data are being studied to determine their association with factors of economic importance, including dwarfism.

The immunogenetics laboratory has processed blood samples from 570 animals this past year. Included were bulls from Laramie, Gillette, and Miles City, to determine the association of blood type and feed-lot performance. The remaining data have come from females at the three stations to be studied in connection with the immunogenetic behavior of inbred lines. Special emphasis has been put toward the identification of additional antigenic factors, and/or systems through a program of within-beef-cattle immunizations.

Radiographic determinations for the detection of dwarfism of all the 1956 calf crop are completed. These results will be compared with profilometer readings and head form measurements as they are obtained.

Preliminary studies revealed no association of feed efficiency with digestibility of feedstuffs as determined by indicators. This study was made of the 1955 bulls on feed test at Laramie.

VI. Work Planned for the Future: The Wyoming subproject has been revised and will continue next year as approved. Greater emphasis during the next year will be placed on the analysis of data on head form and body measurements and their association with factors of economic importance. Techniques for *in vivo* determination of carcass composition will be more thoroughly investigated.

VII. Publications and Manuscripts:

Mason, R. W. 1955. An immunogenetic study of the Miles City (Montana) inbred lines of beef cattle. (Abs.) Wyo. U. P. 19:84.

Schoonover, C. W. 1955. A study of recessive dwarfism in Hereford females. (Abs.) Wyo. U. P. 19:98. July 15.

Stroble, C. P. 1955. A study of the possible association of blood groups and feeding performance of beef cattle. Wyo. U. P. 19:105-106. July 15.

PROJECT SUMMARY
Fiscal Year 1955-56

a. Cattle Inventory

State Wyoming
Date June 1, 1956

Line designation	U.W.Hereford	Gillette Herefords	U.W.Angus	U.W.Shorthorn	Dryer
Breed	Hereford	Hereford	Angus	Shorthorn	Here-ford
Station	Laramie	Gillette	Laramie	Laramie	Lara-mie
Bulls (12 mo. or over)	3	4	2	3	0
Cows (2 yrs. or over)	29	34	26	23	10
Heifers, yearlings	7	9	4	6	6
Bull calves	16	12	16	14	6
Heifer calves	9	8	9	7	4
Percentage use for breeding project	100%	100%	100%	100%	100%
Estimated cash value	$10,825	$10,025	$9,700	$10,500	$3,180

b. Young animals which were on feed during 1955-56.

	Hereford						Angus		Shorthorn	
	Laramie		Gillette		Grades		Laramie		Laramie	
	Ind. fed	Group fed	Ind. fed	Group fed	Ind. fed	Group fed	Ind. fed	Group fed	Ind. fed	Group fed
Bulls	13		13		1		9		13	
Heifers		12		9		9		5		9
Steers										

c. Land, physical facilities and equipment used 1955-56.

	No.	Actual Cash Value	Percentage use for beef breeding project
X-ray machine	1	$5,000.00	50%
Tractors (lease)	4	1,250.00	50%
Neck chains		40.00	100%
Forage harvester (lease)	1	455.00	70%
Manure spreader	2	97.12	80%
Feed bunks	2	300.00	100%
Meat lab equipment		400.00	80%
Meat lab scale	1	1,263.00	80%
Blood lab equipment		300.00	100%
Fencing		200.00	60%
Silage pit	1	400.00	100%
Posting machine	1	725.00	20%
Beef equipment		30.00	100%

d. Cow production data 1955 calves.

Breed	Hereford P.B.	Angus	Shorthorn	Hereford	Grade Herefords
Line	U.W. Herefords	U.W. Angus	U.W. Shorthorn	Gillette Herefords	Dryer Hereford
No. cows bred	31	24	28	32	11
No. calves born					
(a) alive	28	14	24	27	11
(b) dead	3	0	2	2	0
(c) total	31	14	26	29	11
No. calves weaned	27	14	24	27	10
Percent calf crop					
(a) birth	100%	58%	93%	91%	100%
(b) weaning	90%	58%	86%	84%	91%

Average	Bulls No.	Bulls Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Heifers No.	Heifers Ave.	Bulls No.	Bulls Ave.	Heifer No.	Heifer Av
1. Birth wt.	13	73.7	15	69.8	9	59.2	5	55.0	13	73.8	11	68.4	19	73.6	10	64.7	2	76.5	9	7
2. Weaning age		177		175		157		173		177		184		163		153		185		175
3. Weaning wt.	13	359	14	339	9	383	5	362	13	418	11	372	17	345	10	298	1	415	9	33
4. Weaning wt. (Adj. 180 days)		362		347		428		376		423		365		364		320		406		343
(a) Cond.																				
(b) Conf.	13	4.15	14	4.43	9	5.44	5	6.80	13	5.15	11	6.54	17	5.92	10	5.46	1	4.00	9	3.7

e. Feedlot performance 1955-56 .

Heifers group fed by sire group.
Bulls individually fed.

Ration 1:1
Alfalfa - 225 Oats - 5
Barley - 100 Corn - 5
Wheat bran - 25

Breed	Herefords		Angus		Shorthorn		Gillette Hereford		Grado Herefords	
Line	U.W. Herefords		U.W. Angus		U.W. Shorthorn		Gillette Hereford		Dryer Herefords	
Sex	M	F	M	F	M	F	M	F	M	F
No. on test	13	12	9	5	12	9	13	9	1	9
Average:										
Age on test	191.2	189.5	173.6	192.6	194.3	197.5	232.4	234.2	199	188.7
Initial weight	382.0	345.3	411.1	395.-	453.9	381.3	381.9	370.-	430	343.7
Initial score										
(a) Cond.										
(b) Conf.	4.15	4.43	5.44	6.80	5.15	6.54	5.92	5.46	4.00	3.78
Days on test	168	168	168	168	168	168	140	140	168	168
Gain										
(a) Total	4738	3411	2759	1230	4228	2648	3680	2275	415	2982
(b) Average	364.4	284.3	306.6	246.-	352.3	294.2	283.-	252.8	415	331.3
Efficiency of feed utilization										
(a) #TDN/100# gain	443.2	519	499.3	527	497	595	353.8	457	412	488
or										
(b) #Gain/100# TDN										
Final weight	746.5	629.6	718.3	641.-	806.2	675.6	665.-	622.8	845	675.-
Final score										
(a) Cond.										
(b) Conf.	5.69	5.0	5.56	6.6	6.42	6.67	13-4.38	9-5.67	6.00	5.88

f. Phenotypic classification of calves arranged by profile type and by breeding tests of sires and dams A 56

	Number of Progeny											
	Normal calves			Dwarf calves			Premature or stillborn			Died before 2 months		
	Sire classification by profile			Sire classification by profile			Sire classification by profile			Sire classification by profile		
	+d	++	Int	+d	++	Int	+d	++	Int	+d	++	Int
Proven carrier cows		1										
Daughters of proven carrier bulls		8	4G					2				
Daughters of bulls profiled +d												
Daughters of bulls profiled ++		5	2G									
Daughters of bulls profiled Int		15G						2G				
Daughters of bulls, classification unknown		9G							2G		3	

G = Gillette Herefords

Additions to and Discussions of State Reports

Arizona

Dr. Roubicek stated work was continuing with the Boice herds near Tucson and data are being processed under IBM systems. He noted that variation in conformation within herds had decreased considerably during seven years. Nevertheless, variation in weights was still high. He reviewed the cooperative work with New Mexico on dwarfism and cooperative testing program on U. S. Range Station bulls at San Carlos. The initial calf crop under this program will be available in 1957.

California

Dr. Gregory preferred to present the dwarf research program later on in the meetings and asked Dr. Rollins to cover the balance of the California project work. Dr. Rollins referred to the delayed testing work--growing out calves for six months postweaning, then placing them on comparative tests. He felt this procedure might be more sound in relation to current marketing procedures. In reviewing the cooperative test of inbred bulls on a reciprocal basis with Colorado, he cited the early difficulties that had been encountered. Rollins reviewed the two anomalies that have occurred in the experimental herd, (1) depressed temple, and (2) double cervix. He indicated difficulty in correlating long yearling weight of heifers in the San Joaquin herd with heritability estimates at weaning time.

Colorado

Dr. Stonaker said he worked on selection indexes during the past year and was still in a quandary as to what to select for. He was interested especially in weaning or initial weight (actual), daily gain, days to finish, and feed efficiency.

Blackwell said that if Stonaker used uncorrected weaning weight data in selection it would favor cows that calve early.

Correlation between radiographs and profiles on yearling bulls is low (.29) but positive. However, Stonaker expressed the opinion that it does not seem there is much agreement from the standpoint of trying to apply predictions.

Somascope readings were made on bull calves being tested.

Stonaker said he had included nine Shorthorn-Angus bred heifers in his control herd this year and that they will be bred to a new bull each year selected on basis of grade. Five dwarf calves were dropped within the control herd this spring.

Hawaii

Dr. Wayman described the grading system being practiced under their project, which involves year-round grazing. He referred to the increasing number of

breeding cows being brought into the program by the cooperating ranchers. He cited new evidence that the dwarf gene exists in herds in the Territory.

Idaho

Dr. Christian spoke of the difficulties encountered in keeping test animals on pelleted rations. Bogart recommended that the alfalfa in the ration be cut 1/2" long. Christian plans to do some reproduction work with beef cattle determining age at puberty and age at first ovulation and relationship between these two variables, and as cows calve palpate for involution of uterus. He is interested in the heritability of these phenomena as they may affect reproductive efficiency. He also hopes to get under way cooperative work with breeders comparing their own bulls with ROP tested bulls sponsored by the University of Idaho.

Montana

Mr. Willson reviewed the cooperative work with breed associations in which systems of selecting bulls are being compared. Unfortunately, the three Hereford bulls that have been furnished by the association proved to be carriers of the dwarf gene. Nevertheless, Willson believes this cooperative approach has stimulated breeder interest in the research program. He referred to work on the value of selection indexes which when applied on certain animals gave surprising results. Willson believes we should work other criteria such as gaining ability and 12- to 18-month weights into a selection program.

On recurrent selection slight advantages have been observed in crossline groups over Line 1 stock from the U. S. Range Station. Also, a lower incidence of bloat was observed in crossline stocks. On carcass appraisal crossline steers graded higher than controls in all cases.

Nevada

Dr. Kidwell reviewed the work his station was doing on possible genetic-environmental interactions since this is of paramount interest to a range state like Nevada where virtually few range bulls are produced. He spoke on the necessity of resolving our measurements of traits of economic importance into production economics. He said any steer showing dairy breeding was graded inferior.

By using more refined techniques of filter paper electrophoresis of blood he was unable to demonstrate the significant differences between dwarf and normal animals that he had observed when he had previously used crude apparatus.

New Mexico

Dr. Blackwell explained his work in collaboration with the Denver office on IBM processing of New Mexico station herd data which has been gathered during the past 20 years. The herd was closed in 1936. He described the small and hydrocephalic calves that were now showing up in the herd. A

breeding test in cooperation with Arizona has demonstrated that a profiled carrier bull sired a calf that had the characteristics of the abnormality that has appeared in the New Mexico herd. Another bull has shown up as a carrier and he, too, is being tested at Tucson.

Cancer eye investigations have revealed that age is an important factor in the appearance of cancer eye.

The type study has revealed advantages in favor of big type cattle over compact type. The main differences are size differences--daily gain and final weight. Carcass information also tends to be in favor of big type cattle.

Lifetime reproduction performance has been higher in big type cows, an average annual production of 361 pounds for the large cows against 283 pounds for compact cows.

Oregon

Dr. Bogart reported marked improvement in their cattle through the use of a selection index. Rate of gain has been raised by 1/2 pound or more per head per day at a saving of 125 pounds of feed per 100 pounds gain. Differences in individual bulls of from 1.8 pounds to 3.65 pounds per head per day have been recorded. Physiological studies have been initiated to find the factors that cause these differences. Inefficient animals have a tendency not to store amino acids as protein. Paper chromatography reveals that certain amino acids are excreted only by poor-doing animals.

Studies on scores and body measurements showed that higher animals at withers were in general scored the lowest. However, the higher animals at withers were deeper bodied and deeper chested. Chest width and chest depth were related to shorter bodies and shorter bodies related to inefficiency and slower gain.

U. S. Range Livestock Experiment Station

Mr. Quesenberry reviewed the previous work of the station and referred to the difficulties involved in keeping some of the inbred lines going. Work is being planned on studies of early calf losses for approximately six percent of the calves are either stillborn or die at an early age. Cooperative testing with the Ohio station has shown Miles City steers consistently outgained and outperformed steers from other sources.

Crossline matings in some cases appear to offer promise of increased production.

Discussion followed on the merits of crossline testing prior to discarding of lines.

Utah

Mr. Bennett discussed the testing procedure he was using and the rather good results he obtained feeding a completely pelleted ration with the exception of feeding disturbances this year which necessitated revision of feeding late in the test and use of long hay and grain fed separately.

Antipyrine readings, body and carcass measurements and grades were taken on 250 steers. While very good correlations were obtained, these were not good enough for individual comparisons.

Tritium oxide was tried as a means of estimating body composition. It appears to be an accurate method and has high repeatability but initial instrumentation costs are high.

Paper chromatography studies on Hereford dwarfs appeared promising but so far only quantitative differences have been demonstrated. Qualitative differences also may be involved in some of the components. Further work is being undertaken to try to develop a simple test method for present methods are long and exacting.

* * * * * *

Mr. Willson stated that since Mr. Chas. E. Bell of the Federal Extension Service had to leave the meetings early, he would call on him for a statement.

Mr. Bell referred to the practical application of research findings and to the problems incident to this which had been discussed during the recent meeting at Reno. He said he was concerned about the different approaches being taken in the 48 states, and was directing effort toward getting uniform programs of testing throughout the country. He stated Extension people are working closely with research people and leaning heavily on them for guidance and direction. He closed by saying perhaps it was a good thing there are differences of opinion, for that is stimulating.

Washington

Dr. Fowler reviewed previous work of the station under W-1 and said that in addition to development of lines he was interested in establishing short-cut methods of identifying animals possessing high rate and economy of gain. He explained the cooperative work with the Extension Service and private breeders and noted the increased interest in this phase.

In radioactive iodine (I^{131}) studies it appears that slower gains (less than 2.3 pounds per head per day) are associated with higher uptake of I^{131} into the thyroid gland, whereas faster gains (above 2.3 pounds) are associated with higher excretion of I^{131} in the urine. Further experiments in technique are being developed.

A discussion followed on the use of field test data.

Wyoming

Dr. Stratton explained the line development work with Herefords, Shorthorns, and Angus. In crossline matings calves sired by the U. S. Range Station bulls out of inbred cows from the Dreyer line have consistently performed well, while on test showing .38 pound per head per day greater gain than straight-bred cattle of comparable initial weaning weight.

Carcass measurements on test animals revealed that 12- to 13-month-old bulls had rib eyes approaching those of 24- to 30-month-old steers.

Profiles have been taken at nine months and again at 15 months to test repeatability. Of 42 head in Group I at nine months, 33 remained in the same classification at 15 months. Of 112 head in Group III at nine months, 97 remained in that classification at 15 months.

Business Meeting

Thursday, July 19, 1956 - 3:45 P.M.

The meeting was called to order by Mr. F. S. Willson, Chairman, who asked if there was any old business. Since there was none, Mr. Willson proceeded.

The time, place, and duration of the 1957 meeting was discussed. The Western Section meetings will be held at Pullman, Washington, July 15-17, 1957. Dr. Christian invited the Committee to meet at Moscow, Idaho. Dr. Wayman moved that the Committee accept Idaho's invitation to hold the W-1 meeting in Moscow during July 17, 18, and 19, 1957, starting on the afternoon of July 17 immediately following the Western Section meetings, and ending at noon July 19. Dr. Bogart seconded the motion. Motion carried.

Dr. Bogart moved that Dr. Kidwell of Nevada be confirmed as the next chairman, in keeping with the method previously adopted by the Committee to name the chairman from the state next in alphabetical order. Dr. Wayman seconded the motion. Motion carried.

Dr. Roubicek introduced the subject of the literature review, which had been discussed at the committee meeting in Fort Collins in 1956. Several years ago the need for a literature review and the possibility of compiling one was discussed with the several coordinators and Agricultural Research Service officials from Washington, and Dr. Roubicek started the work. The mechanics of making the reviews and the sources of information used were explained. He stressed the desirability of each station participating, using the Denver office as a clearing house. He had tried originally to bring other regions and individuals into this effort to add to the effectiveness of the reviews, but had concluded that they could best be kept active and current if the work were kept in the Western Region, although workers in all areas would benefit from this effort.

Dr. Roubicek recommended that the various sections be assigned to different committeemen. Dr. Stratton suggested that the committee consider the matter of the literature review further and decide on a course of action at the next business session.

Distribution of committee reports was discussed. Some members expressed the view that Technical Committee Minutes and Reports should not be sent to non-technical personnel who might not be in a position to interpret the content correctly.

Meeting adjourned at 5:30 P.M.

Friday, July 20, 1956 - 3:45 P.M.

The meeting was called to order by Mr. Willson.

Dr. Wheeler discussed the subject of insuring continuation of Federal and State support through the application and dissemination of research accomplishments and translated the thinking of the Western Directors in this regard. He referred to the difficulties involved and the problems requiring coordination of colleges, extension, and research. He felt we had not explored all of the possibilities, yet we have so many channels of information

that sometimes it becomes confusing. He said dissemination of sound information while not a specific task of research workers was nevertheless an implied one. Repeatedly the Western Directors, various Branches of ARS, and the Committee of Nine bring up this subject of interpretation and application of research findings. Some points of criticism have been raised at times. Dr. Wheeler then said that fortunately W-1 has not been the subject of these criticisms, but we should not be complacent or above taking a good look at ourselves from time to time.

Mr. Willson expressed the opinion that the group realized the soundness of Dr. Wheeler's remarks, and called on Dr. Shelby, as Acting Coordinator.

Dr. Shelby stated that Dr. Clark left last March to accept a research grant in Australia. He left Denver on March 15, and stopped in Hawaii and in New Zealand en route to Sydney. He sent greetings to the group as expressed in the following statement:

"I wish to convey my best regards to all members of the W-1 Technical Committee and to the honored guests. I certainly regret that I cannot join you at Davis, for I had been looking forward to this California meeting which we have been planning with Paul Gregory and his co-workers. But, offsetting that, I can assure you that I am working with people in Australia who have a high regard for our Experiment Stations in the Western Region since we have some things in common.

"There are contrasts, too. In the winter the sun is low in the North instead of in the South. The trees shed their bark instead of their leaves. Most of the animals run on two legs instead of four. In a horse race the rank outsider that manages to win is called a 'fair cow.'

"So far the predominant beef breed in Australia is the Shorthorn. In the history of horned Herefords, since the formation of the Australian Society only two bulls and three females are reputed to have been shipped in from the United States. However, over three hundred polled Herefords have been brought in.

"Beef seems ridiculously cheap here in comparison with other items. The sheepmen are rich, and, as one Queenslander told me, 'the cattlemen are paupers by comparison.'

"I have been in all of the states except the Northern Territory. I will go up there in July with Dr. Franklin, who is well known to some of you. He has been extremely helpful and hospitable to me and my family. I have a lot of country to cover in that section and in Queensland. It will push me to finish within my allotted time. This is a big country.

"Americans in general are well thought of here. This part of the British Empire is vastly different from Canada, particularly with reference to the outlook of the people. New Zealanders resemble Canadians in their approach to problems. They are quite direct and utilitarian.

"One thing I have learned which I feel is very worthwhile. It pays to get away and take a long look back at what one has been doing--to reflect on things in general, and in particular to plan what we can do to make our work more effective.

"I am looking forward to seeing you all this fall when I get back on the job."

Dr. W. E. Shaklee of State Experiment Stations Division was introduced to the group.

Dr. Shaklee expressed pleasure in attending the meeting of W-1, stating that the meeting was very educational since most of his work had been in poultry breeding.

He reviewed summaries that had been completed by SESD on all research done on Federal grant funds at state experiment stations and pointed out these do not include other research.

He also requested that SESD be kept on the publications list so they could keep up to date on what is being published.

Mr. Willson called on Dr. Walter R. Harvey of the Livestock Research Staff, Biometrical Services of Agricultural Research Service.

Dr. Harvey outlined the history and present status of Biometrical Services. This organization which was originally set up as a consulting agency with a plant and animal staff has been expanded considerably. A computing laboratory has recently been established at Beltsville to process data for members of Agricultural Research Service.

Mr. Willson then called on Dr. E. J. Warwick of the Animal and Poultry Husbandry Research Branch of Agricultural Research Service.

Dr. Warwick made a few general comments on the progress of the regional beef cattle breeding projects. He felt that they had been most productive in the few years in which they have been underway.

The tremendous popular acceptance of the beef cattle breeding research in the past 2 or 3 years was mentioned. The responsibility of the research worker in presenting his results to the public in a usable fashion was stressed.

An educational exhibit, featuring live animals together with actual carcasses, to be prepared for the International Livestock Exposition was discussed. Arrangements to obtain suitable steers from a Colorado breeder were pending. Dean Kildee had mentioned the feasibility of an annual exhibit at Chicago.

The status of line testing in other regions was outlined. The lack of valid comparisons between lines and between breeding plans was emphasized. Attempts to test lines from other stations are currently being conducted only at Mississippi, Tennessee, and Fort Robinson. The need for additional study in this aspect of our breeding program was emphasized.

The importance of and familiarity with research being conducted in other regions was stressed. Exchange of ideas with these research workers is important. Coordinators, and possibly technical committee chairmen, should attend at least one other regional meeting each year.

Report of the Special Committee on Carcass Evaluation - Carl Roubicek, Chairman, F. S. Willson, and P. O. Stratton.

Dr. Roubicek:

A system of coding has been approved by the Beef Carcass Evaluation Committee of the Reciprocal Meats Conference but has not been adopted by the entire group. A straight line system is used as follows: High Choice 4, Average Choice 5, Low Choice 6 ... and Low Canner 24.

Wyoming has proposed a uniform system of coding carcass and live animal grades which can be used on IBM. This system would not replace the other, but would be used in conjunction with it. Perhaps someone from the technical committee should work with the Reciprocal Meats Conference.

Nothing really new or different in procedures has been developed by the Reciprocal Meats Conference. Their recommendations are available in the proceedings.

Dr. Stratton:

Accuracy of rib eye tracings made under packing plant conditions is often low. Colored photographs taken at a specific distance from a rib eye, covered by a standard grid, overcome this difficulty. Area of eye, lean, and fat can be easily determined.

A new measurement for carcass evaluation has been devised by Schoonover.

A DEPTH OF ROUND MEASUREMENT FOR BEEF CARCASSES REPLACING CIRCUMFERENCE OF ROUND

A new measurement, depth of round, replacing circumference of round has been used successfully in carcass evaluation at the University of Wyoming Meats Laboratory this year. The circumference of round as generally used, is a difficult measurement to obtain, the repeatability is rather poor, and as other carcass measurements are length or width measurements (except area of eye) it was felt that a depth of round measurement would be easier to take and would fit in better with other measurements.

The new depth of round measurement is based on a set circumference of round measurement rather than a variable one. This circumference has been set at 75 mm., and approximates, except in very large or very small rounds, the area where the heel of round would normally be removed.

The measuring device was constructed from a piece of plastic laboratory tubing slightly less than 75 mm. long, with a piece of copper insulated wire drawn through the center and two hooks attached to the ends of the copper wire. In use, the device is placed around the round and hooked together. A shroud pin may be used on the dorsal part of the round to keep the device from slipping up. The depth measurement is then made from the anterior edge of the aitch bone to the center of the plastic enclosed wire.

Several advantages in computing data are evident: first, length of loin plus depth of round will yield a linear measurement of the most valuable parts of the hindquarter; second, length of leg divided into depth of round will give a comparative value in percent of the particular carcass.

A short discussion on criteria used in carcass evaluation resulted. Drs. Roubicek, Kidwell, and Mr. Jacobsen participated.

Special Committee on Nomenclature. J. F. Kidwell, Chairman, J. A. Bennett, Oliver Wayman.

A circular letter was sent to the technical committeemen requesting suggestions. The replies expressed the feeling that it would be inappropriate to try to write a dictionary of genetic terms, but that some attempt should be made to standardize those terms commonly used. One solution was for each group of authors to define their own terms as they are used. Some terms for inclusion in the written report were suggested. The recommendation was made that the committee be continued, and that a group of terms whose definitions are not already well accepted be assembled.

Special Committee on Selection Index. R. L. Blackwell, Chairman, Ralph Bogart, J. R. Quesenberry.

Dr. Blackwell:

Selection indexes are not in common use in beef cattle as appropriate statistics are not available. These must be obtained as soon as possible. The following items are needed to devise a satisfactory selection index: the real economic worth of the traits, their heritabilities, and the genetic and phenotypic correlations between them. These paramaters are combined in such a fashion as to give an equation which will predict the genetic merit of an animal. Such equations can be either simple or complex.

Our Extension friends are probably worried about our talks on selection indexes. Many of the terms used are not meaningful to them. It behooves us to educate the people to what they mean.

We do not get all the information we want to include in a selection index. For instance, the dwarf problem comes under this category. An index might be worked out with regard to this problem. No problem exists as to whether a dwarf animal should be saved. For all practical purposes the index value of a carrier would be zero regardless of what the characteristics might be in other directions.

Cancer eye susceptibility cannot be measured until an animal is fairly old, often at the end of productive life. Ways and means of taking these into consideration are available.

Dr. C. R. Henderson has done a great deal of work on the selection index problem and has added materially to the material on how to compute or develop selection indexes, superceding the procedures set forth by Hazel and Fairfield Smith.

Possibly, several combinations of economic values, heritabilities, and genetic and phenotypic correlations can be set up in a handbook and used to develop selection indexes appropriate for a certain set of conditions and traits. Whether a trait is 20 percent or 25 percent heritable is not important. The important thing is whether it is 20 or 70 percent heritable. Weighting factors change very little if heritabilities or genetic or phenotypic correlations change slightly.

A complicated equation does not have to be presented to the rancher. We need only to say to him, "Select for these traits, use this combination of factors, and make your selection accordingly."

The major work ahead of us is in evaluating the genetic and environmental correlations between traits. This must be done before suitable indices can be devised.

Discussion:

Dr. Blackwell:

I believe a selection index infers that the genetic selection we are heading for is additive. The principle of forming inbred lines in part means we are trying to find out whether or not variation is additive. The selection index is not the final answer to improvement but is the answer to that portion of the genotype which is additive.

Dr. Kidwell:

If the most part of the variance is not additive, then our heritability estimates should not be as high as they appear. If they are really this high, should less attention be paid to the differences of inbred lines?

Dr. Blackwell:

Our problem aside from developing something that people can use early is finding out more about the matter of the gene involved. Dr. Gregory is showing us that there is a tremendous amount of genetic interaction in various traits. I would hope that our estimates of heritability are truly as high as indicated. Crossing of inbred lines seems to be the answer to that question.

Dr. Bogart:

Even if heritabilities are high and the developing of inbred lines is not the thing to do, we are having a difficult time making selections without doing a certain amount of inbreeding, as herds are so small. Where are we going to get unrelated stock and have records sufficient to work in with the stock. We need to think about some other factors in the use of selection indices. How well standardized is the information used in our selection? What adjustment factors will be needed? What part of our data actually may be used in selecting our animals?

Dr. Blackwell:

The heritability estimates that one gets at a particular station may not be appropriate at others. Can we take the Miles City, New Mexico, and other estimates, and combine them to get an accurate estimate?

Special Committee on Gene Interaction. H. H. Stonaker, Chairman, P. W. Gregory, M. W. Galgan.

Dr. Stonaker:

Dr. Gregory is doing as much gene interaction as anyone in this country at this time. Personally, I am pessimistic that we can offer in many cases much evidence of this subject in beef cattle with the exception of such stations as Dr. Gregory's.

Dr. Gregory:

I might say a few things here. We are dealing with the whole phenomenon of growth and development. A lot of things have been happening in beef cattle. Two viewpoints have been held for the past thirty years or more, i.e., of the purebred breeder and the livestock judge, and of the commercial cattleman who is raising beef. Thirty years ago, the commercial man said, "If we select the type of bulls the judge and purebred breeder want, we cannot maintain the size of our cattle." I have heard this many times in the past thirty years and still hear it.

In this dwarf study we are dealing with a part of the dwarf/complex that is involved in cattle degeneration. It is being attacked in a good many ways. We are trying to find out what each gene does, and what the norms are for each allele and the various combinations. That brings us into differential diagnosis, recognizing these types. I am not as pessimistic about these various genes and interactions as expressed by others. There is a lot of hard work in it. I think we are going to have to use every approach or every technique at our disposal--anatomy, histology, cytology, chemistry. The cataloging of our different genotypes is one of the major obstacles to the solution of this problem.

I expect to continue on gene interactions, measuring and evaluating each gene and what is involved in each complex. I have an enthusiastic group of young people in other fields of genetics and in veterinary medicine. Quite a lot of productive things should come out of our study. We expect to make contributions to clinical medicine, public health, and numerous other fields.

Mr. Willson mentioned that there were some project revisions to consider.

Dr. Shaklee stated his Division had gone over the project revisions. He noted the Committee of Nine had recommended that contributing projects be reviewed and that the titles of the revised projects should be more descriptive of the work being done.

Dr. Wheeler reviewed the views of the Committee of Nine on the relationship of state projects to the regional project and how each state should undertake specific objectives.

Dr. Gregory referred to his California project which was revised only a year ago and which embraced several of the regional project objectives, and posed the question whether it would be necessary to revise the California project again. Dr. Wheeler said that if a project has been revised recently and does tie in with the revised regional project it should be satisfactory, but it is a matter for the technical committee to review the state projects and recommend their acceptance.

Mr. Willson asked Dr. Wheeler if the Committee of Nine had found any inconsistencies between Western Regional projects and contributing state projects. Dr. Wheeler stated he could not recall any specific reference to any such inconsistency.

Discussion of the Idaho project took place. Dr. Bogart moved that Dr. Christian rework the Idaho contributing project, submit it to the committee, and each committeeman would then write him if he found it satisfactory, automatically giving it approval. Gregory seconded the motion. Motion carried.

Mr. Willson and Mr. Flower then discussed the Montana project and pointed out that two objectives (D and E) had been added involving the testing of two bulls per herd per year as a minimum and that an attempt would be made to get data on crossline females derived from the Havre testing program probably in cooperation with a private producer.

Dr. Stonaker moved that Montana resubmit their revised project. Wayman seconded the motion. Motion carried.

Dr. Wheeler asked that copies of contributing projects should also be sent to him for review purposes and especially the final copy approved by the committee.

Dr. Wayman suggested that since projects would be approved through the mails each project should carry the name of each committeeman.

Dr. Roubicek proposed that a copy of the approval letter and comments of each committee should go to Dr. Wheeler and to the Coordinator, Dr. Clark.

Mr. Willson said that the minutes would include a statement that in the case of contributing projects a copy of the comments and letters of approval be sent to the Administrative Adviser and the Regional Coordinator.

Dr. Blackwell expressed the opinion that the objectives of the New Mexico project were all right and noted that the project had been approved by the New Mexico Station Director and by the technical committee.

Dr. Bogart moved that the New Mexico project be accepted. Roubicek seconded the motion. Motion carried.

Mr. Bennett referred to the title of the Utah project and that it might not include all of the work being done and specifically the work on dwarfism and paper chromatography. State Experiment Stations Division had approved the project with the suggestion that the title be revised and made more specific.

Dr. Fowler stated that the same situation applied with reference to the Washington project, namely, that the title should be revised.

Dr. Shaklee stated that it would be advisable to have all projects approved by the technical committee before they channel to SESD and that a statement to that effect should accompany the letter of transmittal.

Dr. Stonaker moved that the previous committee action be suspended and that the committee accept the Montana project with an amended title and that circulation to the technical committee would not be necessary. Dr. Roubicek seconded the motion. Motion carried.

Dr. Stratton stated that SESD thought Wyoming should rework its project. The project will therefore be revised.

Dr. Roubicek suggested that instead of a Carcass Evaluation Committee Idaho should have a carcass available at the time of the meeting and that probably more good would come from that than having members working on a committee.

Dr. Stonaker moved that the special committees that have been in effect be dropped. Dr. Roubicek seconded. Motion carried.

The meeting adjourned at 5:30 P.M.

Friday, July 20, 1956 - 9:30 P.M.

The meeting was called to order by Mr. Willson.

Dr. Stratton moved that the literature review be carried on as a W-1 activity in which the various states be responsible for keeping current one or more of the several sections. Mr. Bennett seconded the motion. Discussion by Stonaker, Roubicek, Stratton, and Wheeler on procedures, reference material, and availability of funds to do the job followed. Motion carried.

Sections were taken as follows:

I. Reproduction
Idaho and Montana

II. Prenatal Development
Montana and Idaho

III. Birth to Weaning
Colorado and Wyoming

IV. Postweaning Performance
Utah

V. Carcass and Meat Studies
Wyoming and Colorado

VI. Maternal Factors
New Mexico

VII. Inheritance
California

VIII. Effects of Climatic Environment
Arizona and Washington

IX. Physiological and Metabolic Studies
Oregon and Hawaii

Dr. Wayman suggested that the literature review be revised at least every two years and that a list of reviewers be circulated in order that research workers in all regions could contribute reference material.

Dr. Bogart introduced the subject of distribution of reprints. He referred to the gentlemen's agreement established several years ago to send reprints to all committeemen both in his own region and in other regions. He had complied, but knew that more articles had been published than he had received. Discussion followed, participated in by Willson, Warwick, Bogart, Kincaid, Bennett, and Wayman.

It was agreed that each committeeman would send to the coordinator for distribution 75 copies of all publications not previously distributed to the technical committeemen.

Mr. Willson called on the Administrative Adviser to address the committee. Dr. Wheeler prefaced his remarks by referring to the revision of contributing projects and the need to proceed with this phase as fast as possible.

He reviewed the question of allotment of funds to regional projects, described the mechanics involved and the actions taken by the Western Directors on this topic. He called on the committee to make whatever suggestions they cared to relative to fund allocations.

Dr. Wheeler described the manner in which balances in the P. and C. (planning and coordination) Travel Trust fund had been handled. He stated that this fund also could be used to cover publishing costs of the literature review but cautioned that the money would have to be utilized within a specified time. He personally felt that the literature review could be a real contribution to the progress of W-1, and especially since this field is expanding so fast he could not see how anyone could keep up with it.

Dr. Wheeler then referred to the continuing need for self-appraisal of committee work and cited the efforts of NC-28 in this respect. He stated that many of the questions these men on NC-28 asked themselves can be answered very favorably by W-1, yet some sort of project appraisal might not be a bad assignment. He also referred to the need to work closely with others who are charged with the responsibility of getting information out. He closed his remarks by expressing his pleasure on meeting again with the W-1 committee.

Dr. Roubicek introduced the subject of possible revision in allotments within specific years when a certain state may require an increase in order to accomplish a particular piece of work. He suggested a procedure whereby through mutual understanding each state would agree that up to ten percent of their regional funds could be shifted during the course of a year to another state for one year. The state making the request would do so through the coordinator.

Dr. Wheeler stated there had been some precedent for this in the Western Region, and that it could be done provided the Technical Committee agreed to it.

Dr. Stonaker expressed agreement with the spirit of the suggestion and referred to the difficulties in keeping long-term breeding projects rolling under constantly changing cost and economic conditions. Bogart also referred to the current situation as contrasted to conditions that prevailed seven or eight years ago. Mr. Willson emphasized the need for some stability in project funds.

Dr. Wheeler then referred to the need for ample justification before the committee in advance so that decisions could be reached on a group basis.

Further discussion took place on this topic with several members participating, in the course of which Dr. Bogart indicated he was not in favor of the proposal.

RESOLUTIONS

Dr. P. O. Stratton, Chairman, Dr. Oliver Wayman, and Dr. R. E. Christian:

WHEREAS, Dean C. B. Hutchison, Dr. I. M. Lerner, Dr. C. N. Stormont, and Dr. R. C. Laben have made immeasurable contributions to the 1956 annual meeting of the W-1 Technical Committee,

THEREFORE BE IT RESOLVED, that our sincere appreciation be extended to these men for their efforts.

WHEREAS, the host and his associates have done an exceptional job of organizing and implementing an outstanding program of academic and general interest to supplement the reports and discussions of the 1956 annual meeting of the W-1 Technical Committee,

THEREFORE BE IT RESOLVED, that the committee express its appreciation to Dr. P. W. Gregory and his associates.

WHEREAS, the University of California at Davis has provided fine facilities and wonderful hospitality for the members of the W-1 Technical Committee and guests during the 1956 annual meeting,

THEREFORE BE IT RESOLVED, that the committee express its appreciation to the host institution.

It was moved and seconded that the resolutions be adopted. Motion carried.

Dr. Kidwell made the motion that inasmuch as this is the first W-1 Technical Committee meeting Dr. Clark has missed, someone be delegated to send some expression from the committee to Dr. Clark. The motion was seconded by Dr. Gregory. Motion carried.

Dr. Stonaker moved we express appreciation to Dr. Warwick for his suggestion of interchange of ideas by sending the regional coordinators to the meetings of the technical committees of other regions, and the suggestion that the technical committee chairman also attend. Motion was seconded and carried.

The meeting adjourned at 11:15 P.M.

Phenotypic Forms and Genetic Relationships of the Bovine Dwarf Complex

By P. W. Gregory

Summary

Several markedly different phenotypic forms of bovine dwarfs have been reported in cattle. The types included are short-headed (snorter), long-headed (Baker, et al. 1951), and two different Shorthorn types currently designated as III-A and III-B, the latter characterized by a heavy body with short legs. All were considered by Gregory (1955). These and perhaps others were observed by Koger, et al. (1955). Crosses of the short-headed with the long-headed type have been made within the Angus and Hereford breeds, between the two breeds, and with Herefords and the III-A type of Shorthorn dwarf, resulting in 14 early maturing compresst-like progeny subnormal in size, designated as V-C, and two dwarfs of the short-headed type. One dwarf appeared from the cross within the Angus breed and the other from the Hereford x Angus mating. Matings between the long-headed Angus dwarf and the Shorthorn (III-A type) produced two compresst type (V-C) and one short-headed dwarf progeny. When all the F_1 compresst type (V-C were backcrossed to short-headed dwarfs the resulting progeny were: short-headed dwarf 15, and compresst type (V-C) 5, a ratio of 3 to 1. When the F_1 compresst were backcrossed to long-headed dwarfs the progeny observed were: short-headed dwarf 3, long-headed dwarf 1, and compresst 3. When the III-B type Shorthorn bull was mated to compresst type Herefords produced from dwarf carrier stock, 11 progeny were produced: short-headed dwarf 3, long-headed dwarf 2, type III-B 3, and compresst 3. These results clearly indicate that all the dwarf phenotypes tested are a part of the same genetic complex and that modifying genes are involved which differentiate specific dwarf phenotypes.

An exhibit of all the different forms of the dwarf complex discovered to date was shown.

Note: A complete report of this discussion is now being prepared for publication in a technical journal.

Genetic Homeostasis in Evolution and Natural Population

By I. M. Lerner

Summary

Investigators of organic evolution have long been concerned with the forces promoting genetic changes in populations. More recently, largely as a result of selection studies with domestic and laboratory animals, increasing, increasing attention has been directed towards the conservative forces which bring about in populations under selection pressure the development of resistance to change. In particular, instances in which, at first, gains from selection correspond in order of magnitude to those predicted on the basis of simple models of polygenic inheritance, and later are reduced or completely fail to materialize, are of considerable interest both from the theoretical and the practical points of view.

Among the genetic mechanisms which may account for lack of response to selection are: exhaustion of additive genetic variability or its conversion to non-additiveness in the wake of changed gene frequencies; interaction between genotype and environment; causing selection under the environment of one generation to be ineffective for that of the next; recurrent mutation counteracting the effects of selection; originally present or induced negative correlation between multiple selection objectives, and a number of others.

A variety of the last kind mentioned, which may have some general significance, involves reduction in reproductive capacity (the objective of natural selection) as a result of departure from a genotypic balance, caused by successful artificial selection for some metric or meristic trait. Selection gains in such cases are then obtained at the cost of loss in fitness. A new genotypic balance may, of course, be eventually produced by continued selection pressure, and fitness thereby recovered.

An example illustrating some aspects of this situation is provided by a selection experiment for long shanks in chickens, now in its nineteenth generation. Data from selected, control and selection-suspended lines will be presented and consequences of the model described to artificial selection practice will be noted.

Note: The full report is to be published in the Proceedings of the International Genetics Symposium of the 1956 meeting in Tokyo.

Action of Genes Conditioning Prolonged Gestation in Cattle

By Clyde Stormont, P. C. Kennedy and J. W. Kendrick

Prolonged gestation in cattle has been recognized as a clinical entity for many years, but it was not until comparatively recently that evidence bearing on its causes has been forthcoming. The first evidence relating to its causes was provided by Gregory, Mead and Regan (1951), in a study of the pedigrees of thirty affected fetuses in a single, large herd of Holstein-Friesians. Their data were entirely consistent with the explanation that the kind of prolonged gestation studied by them is conditioned by the genotype of the fetus. They proposed that no more than a single, autosomal, recessive gene need be postulated and they produced evidence to show that approximately one-fourth of the calves from matings of known "carrier" parents are afflicted with this trait. Shortly thereafter, Hallgren (1951) reported on nine cases of prolonged gestation in Swedish Red and White cattle, and he proposed that this particular type of prolonged gestation undoubtedly has a genetic basis since eight of the nine affected fetuses were sired by the same bull. More recently Stormont, Kendrick and Kennedy (1956) have analyzed the pedigrees of a third type of prolonged gestation occurring in Guernsey cattle. The pedigrees of the seventeen affected fetuses traced on either or both maternal and paternal sides to a single bull. As in the cases studied by Gregory and co-workers, we have proposed that this condition, as it occurs in Guernseys, is probably consequent on the action of a single, autosomal, recessive gene. Much of the balance of the present discussion is devoted to a description of the features which clearly distinguish these three kinds of prolonged gestation.

In the Holstein-Friesian cases the fetuses were overdue from 20 to 90 days when the cows came into labor as contrasted with 80 to more than 200 days in the Swedish Red and White cases. The 17 Guernsey cases (excluding three in which the fetuses were delivered by Caesarean section prior to the onset of labor and two cases in which the overdue cows were sent to the butcher) exhibited a more extensive range. The gestations in Guernseys ranged from 256 to 526 days compared with the norm of 282 days. While the majority of the affected Guernsey fetuses were long overdue on delivery, two were delivered prior to the normal due date. Consequently, it is perhaps more appropriate to refer to this condition, as it occurs in Guernseys, as "abnormal" gestation.

The affected Holstein-Friesian and Swedish Red and White fetuses were postmature in appearance and exhibited gigantism as contrasted with the Guernsey fetuses which were small and premature in appearance. The Holstein-Friesian fetuses, although weighing around 145 to 170 pounds in the cases where the cows were permitted to go into labor before the fetuses were taken, were of normal proportions. On the other hand, the somewhat heavier Swedish Red and White fetuses, according to Hallgren, exhibited acromegalic features. The Guernsey fetuses averaged about 50 pounds and were decidedly abnormal in gross appearance. They exhibited varying degrees of hypotrichosis from completely hairless (excepting extremities) to almost normal. Two of the Guernsey fetuses, one with fused nares and compressed face and the other a pseudocyclops, definitely classified as monsters.

Autopsies failed to reveal any gross lesions in the organs and glands of the Holstein-Friesian and Swedish Red and White fetuses. On the other hand, a host of constant anomalies (domed crania, fontanels at the sutures of the cranial bones, internal hydrocephalus, aplasia of the adenohypophysis, poorly developed thyroids and adrenals, etc.) were observed along with more variable features such as atresia of the jejunum and sub-aortic, interventricular septal defects in the Guernsey fetuses. Undoubtedly, the common denominator of many of these features of the complex syndrome in Guernseys is the failure in the development of the pituitary. Most probably this defect in the pituitary relates directly or indirectly to the abnormal gestations.

There are other features which distinguish these three types of prolonged or abnormal gestation--particularly the type studied by us in Guernseys. For example, most of the Holstein-Friesian and Swedish Red and White calves were alive at the initiation of labor and many of the Holsteins were delivered alive but died within a few hours. All the Guernsey fetuses in those cases permitted to go to term were dead and usually quite badly autolysed on delivery. In the Guernseys the only factor limiting the length of gestation appears to be the length of life of the fetuses.

These are also certain common features, particularly as regards the preparation of the cows for parturition. In all three types, the cows carrying affected fetuses show little sign of impending labor as characterized mainly by failure of the udder to develop and virtually no relaxation of the vulva and pelvic ligaments.

In view of these considerations it is logical to propose that at least three genes, perhaps all non-allelic, are involved in conditioning prolonged or abnormal gestation in cattle. Seemingly, the gene or allele studied by us in Guernseys mediates its effect via the pathway of developmental anomalies

and in particular the aplasia of the adenohypophysis. The condition in all three breeds provides unusual opportunity for research on the physiology of parturition.

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The Nature of the Short-headed Hereford Dwarf with Special Reference to the Appendicular Skeleton

By Walter Steele Tyler

Abstract

The literature concerning bovine dwarfism was briefly reviewed. A classification of processes responsible for dwarfism in animals was presented.

The appendicular skeleton of the Hereford dwarf was investigated by gross and histological methods. The complete appendicular skeletons of 53 animals and parts of 16 others were examined grossly. The metacarpal epiphyseal line of 6 normal and 14 dwarf Herefords of the age range 0-2 months were examined microscopically.

A gross general examination of the appendicular skeletons of the Hereford dwarfs did not reveal any constant differences in shape or texture of the bones.

The epiphyseal lines of the appendicular skeleton of Hereford dwarfs appear to fuse at nearly the same age as normal Hereford cattle. The epiphyseal lines of both groups of Herefords appeared to fuse at the normal age reported for cattle in general.

The appendicular skeleton was revealed to be disproportionate with respect to the proportions of the individual bones and with respect to the proportions of each limb as a unit. The young dwarfs were more disproportionate than the older dwarfs.

It was shown that these disproportionalities were due to diaphyses of reduced length. Evidence was presented which indicates that this change occurs in utero. This change is characteristic of achondroplasia.

The most involved bones of the appendicular skeleton were the metacarpal and metatarsal bones.

The histological examination of the metacarpal epiphyseal lines revealed changes most similar to those seen in mild hypoplastic achondroplasia.

A comparison was made of the characteristics of achondroplasia and the characteristics of the Hereford dwarf.

It is concluded that a mild form of hypoplastic achondroplasia is the process responsible for dwarfing in Herefords.

Note: The full report of this paper will be published in two or perhaps three publications one of which will be the American Journal of Anatomy.

Premature Closure of the Spheno-Occipital Synchondrosis in the Horned Hereford Dwarf of the "Short-Headed" Variety

By Logan McKinley Julian

Abstract

A study of 47 dwarf and 31 phenotypically normal Hereford skulls disclosed that premature closure of the spheno-occipital synchondrosis occurs in dwarfs of the short-headed variety. Normal synostosis of this joint occurs between the 24th and 36th month in normal Herefords; whereas, fusion occurs as early as one day of age in the dwarfs. Such premature fusion indicates that achondroplastic processes are involved in the dwarfing processes responsible for bovine dwarfs (short-headed variety). Microscopic and radiological studies indicate that the manner of closure is the same in dwarf and normal animals; the time of onset, and possibly the rate, of closure differs.

Some animals show partial fusion at a period between that of dwarfs and the majority of the normal population. It is suggested that these animals represent an intermediate group and that the alteration is a reflection of the action of the major dwarf conditioning gene.

A brief progress report was given of researches on the growth of the muscular, central nervous, and digestive systems. At one year of age dwarf cattle have smaller muscles by any manner of comparison, absolute weights, relative weights relative to bone length. The expression of dwarfism is less marked in the central nervous system than it is in the somatic tissues. This is one factor which is responsible for the persistent bulge of the forehead.

Note: The full report of this paper will be published in the American Journal of Anatomy.

Some Reflections and Reminiscences of a University Administrator

Annual Meeting of Technical Committee for W-1 Beef Cattle Breeding Project
Davis, California
July 19, 1956

By Claude Burton Hutchison

I am honored by your invitation to speak to you this evening and flattered by the thought of your program committee that one who has done so little research himself--one who terminated his active participation in research as a relatively young man to enter the administration field--could possibly have something of interest to say to such a group as this, occupied as you are in laying a firmer scientific foundation for the improvement of one species of man's most important domestic animals.

Let me assure you at the outset that I shall not discuss a single principle of genetics this evening, nor attempt to show you how it might be applied toward the goals you seek. I am far too rusty--if indeed not in a complete stage of erosion--in the field of which I once professed to have some knowledge, to undertake that. Many, if not most of you, could do a much better job at that than can I; and I shall not embarrass either you or myself by attempting to prove the truth of that statement.

I shall have nothing especially timely to say to you and no burning message or words of great wisdom to leave with you. And if what I shall say has any resemblance to anyone living or dead (save myself) or reference to any event or incident outside my own personal experiences and observations, I assure you it will be purely coincidental.

My purpose this evening will be to recite some experiences and to state some philosophies which I have developed over the years, with the hope that some of the younger men in my audience, some of whom have already been or ultimately will be lured into the administrative game, may find something of interest and possibly something of value in what I shall say. Some of the things which I shall say merely confirm the wisdom of some advice I was given, and thank goodness had sense enough to take, when I entered the administrative field.

What I am going to say will be mostly about myself. I hope you will forgive this and not think me too immodest. After all, in reminiscing, one is most apt to recall events and incidents in which one has had a part. And reminiscing is always tempting to one of my age. Besides, your program committee was gracious enough to permit me to select my own subject this evening--at least to the extent of wording the subject which appears on the program. They did express the hope that I would direct your thoughts to and attempt to describe the kind of academic environment that is most favorable for productive scholarship. I will get to that in due course, but first let me say right now that good administration has just that very thing to do and no administration is good that does not strive always to create just such an environment.

I am not a moralist, however, nor a missionary. I have never aspired to save anyone--least of all university administrators, and I shall not try to do so this evening. Most administrators have to learn--often the hard way--in the

hard school of experience. If one has vision and imagination, good judgment, a lot of good common horse sense, the ability and willingness to make decisions, sense enough to think things through--not to think merely of the problem at hand but to anticipate the effect which a decision made today may have tomorrow, next week, next month or next year--and let's say 80 to 90 percent of his decisions are right--he has done about as well as we can expect a human being to do.

There isn't much one can study, I think, to prepare oneself for university administration, although I admit that some attempts are being made in this direction. Administration is certainly not a science and I doubt if there are many well defined principles upon which one can completely and with full confidence rely. Certain rules and regulations can perhaps be devised, but at best they can serve only for guidance. One of the wisest administrators I have known put it this way, "Rules and regulations are for guidance. When you find a rule prevents you from doing what you know should be done, it is time to set aside or change the rule." That is where administration comes in--the exercise of judgment. If an institution could be run by rules it wouldn't need an administrator--a chief clerk or a policeman would do.

I am quite sure there is no one best form of university organization or administrative procedure for all. Each institution is an individual enterprise--a dynamic, living, individual organism which has evolved in its own way and in response to its own environment, human as well as physical. An administrator can only help guide that evolution in a way that promotes a healthy environment for teaching and learning--the only reasons for a university's existence.

I got into the game of university administration as a relatively young man. Since my age at the time is a matter of public record I have no hesitancy in admitting it. I was 37. I was a youngster yet and had a lot to learn, as a good friend and himself an able university administrator so wisely and so pointedly advised. Incidentally, may I say with mixed emotions too, that I have done no formal university teaching or research since the age of 39.

Now, how does one become a university administrator? Some by design or ambition, of course--but mostly, I think, by chance. Some by immediate circumstances in their institution, are tempted into it--or even victimized by being offered a higher salary. In this way, sometimes a good scholar is transformed into a mediocre or poor administrator, and some minds are too valuable for the University to use them in administration.

I had no administrative experience save the chairmanship of a small department for about three years, when I accepted the University of California's invitation to become Director of what was then called the Branch of the College of Agriculture on this Davis campus.

I had been a professor in two other American universities and at the time was happy and content in teaching theoretical genetics and in studying the genetics of maize. I had no special ambition that I can recall to do anything else. I was doing what I wanted to do. I believed then, as I believe today after almost a third of a century of administrative experience, that the most desirable post in a true university is a professorship. I believe that in a university worthy of the name the objective of its administration should be to encourage among its faculty and students the accumulation and diffusion of knowledge through teaching and learning--the advancement of knowledge through research--and above all the opening of new vistas to youth

to an understanding of man and his physical, social, moral and spiritual environment, with minds well trained and disciplined, free to seek and discern the truth, free to state the truth as they see it. Teachers do these things, ladies and gentlemen, not administrators. Teaching and learning is the goal. Administration can only help--or possibly retard--the attainment of that goal.

A university's greatest product is its students. If I have any regret in my university experience, it is that I cannot point with pride to the accomplishments of my students--at least very many. But I hasten to assure you that I do have much pride in the accomplishments of the young men I have gathered about me over the years, most of them in this university, and in whose success I like to feel I have had a little part by helping to create a favorable environment for them in which to work happily, contented and productive.

The next greatest product of a university is its contributions to the advancement of knowledge, for upon the advancement of knowledge depends the advancement of human welfare. Evil men may misuse knowledge for personal prestige, power or gain, but that is no indictment of knowledge itself. Therefore no institution is worthy of the name university that does not provide facilities and actively encourage members of its staff to do something to advance the frontiers of knowledge in their respective fields of scholarship. Research even of modest proportions vitalizes teaching and stimulates curiosity, in contrast to stale textbook and encyclopedic information. Much of the latter is ultimately forgotten and likely as not some bright and curious young man next week will prove it wasn't true anyway!

But, to get back to administration. Why and how was I tempted to embark on this precarious journey? I suppose the reason I went into administration was about threefold. First, there was the telegram--that telegram which I found on my desk one morning, just before going into the classroom to deliver one of my famous lectures in genetics! Would I come to Washington to discuss the possibility of an invitation from the University of California to become Director of the Branch of the College of Agriculture at Davis? Oh, yes! You have guessed it--the salary mentioned was some 70 percent greater than my own university at the time deemed my services to be worth! Was this "opportunity knocking" at my door? I had better go down to Washington and see!

A second reason was more personal--a self-appraisal of my own shortcomings--with the ultimate conclusion, right or wrong, that interesting though what I was then doing might be, I was not likely to make any great contribution in my chosen field of scholarship. I hadn't, up to that time. Why should I expect to do so in the future? One of my teachers used to say if a man hadn't done some important research by the time he is thirty, he is not likely to do so. I am inclined to agree. But please do not misunderstand me. We cannot all be Nobel Prize winners or even members of the National Academy of Science. And I do not underestimate the value of the contributions of the "hewers of wood" and the "carriers of water" which most of us must be--the small contributions--the filling in of the gaps--even the empirical investigations often necessary as the first steps in opening up new fields of inquiry.

The third and perhaps the most important factor in my decision was an emotional interest in agriculture and in rural people from which I had myself sprung through many generations and the thought that perhaps in the administrative field I could make a more important contribution to agricultural science and agricultural education and hence to human welfare, than by my own individual efforts in a single field of science.

I had grown up and had my undergraduate university educational experience at a time when practical things were emphasized in the curriculum of most colleges of agriculture. Faculties of agriculture were supposed to train farmers and more often than not, they as well as others in those days, measured their success by the percentage of their graduates who returned to the farm. Some graduates, to be sure, were beginning to seek and find employment in various industrial and commercial activities related to agriculture, but in nothing like the numbers that do so today. Some were offered and like myself accepted, assistantships in some department of a college of agriculture and because of the old law of supply and demand were soon promoted to positions of more responsibility than their educational experience had equipped them adequately to assume. As for graduate study, the extreme view was held by some college administrators that only the lad who could not find a good job upon completing his undergraduate work continued his formal education through graduate study. The most able graduates were encouraged to go to work, on the farm, in the university, or elsewhere; the less able perhaps had better continue their education until they could get a job.

Such was the situation in agricultural education in America at the turn of the present century--and let me assure the youngsters in my audience that, strange though it seems, I do not greatly exaggerate. Here and there, of course, some attempts at improvement were being made. Congress was to pass the Adams Act in 1908 (or was it 1906), the first step taken nationally to encourage basic research in agriculture, and a few agricultural experiment stations were beginning to make greater use of the tools of science in their work. But, by and large, agricultural research in America was still dominated by empiricism and agricultural instruction by practical information. Even as late as the early nineteen twenties the director of the Experiment Station of one of our greatest agricultural states could ask, "Under what project did Darwin work?"

It was this situation that attracted my interest and the conviction that a more basic approach to agricultural research and instruction was needed that led me to accept this university's invitation to an administrative post. The educational preparation currently expected of young appointees, the period of apprenticeship through which they pass before attaining tenure, and the role which the basic physical, biological and social sciences play in agricultural research and instruction today strikingly evidence the progress that has been made in most colleges of agriculture in this country during the past third of a century. There is one notable exception to this, namely, in agricultural extension, where with very few exceptions much less educational preparation is still accepted of appointees than for those who engage in resident teaching and research, despite the fact that we say that extension work is teaching, that all three are of equal importance, and that salaries, tenure, and other elements of compensation should be the same.

Time will not permit me to develop this point further, but let me say categorically that extension work in agriculture and home economics in this country today is still in the hands of men and women whose educational preparation on the average has been much less vigorous and thorough than that which is now commonly demanded of the resident staff. If we are ever going to make extension teaching academically respectable, not merely in the College of Agriculture but in other parts of the university it is high time we demanded equivalent educational preparation as we demand of resident teachers.

I have never regretted my decision to enter administration, notwithstanding the occasional nostalgic feelings I have from time to time experienced. The

dynamic situation we have had in this growing State of California during the past three decades, the generous support of our work by the State, the stimulating encouragement of my superior officers, the loyalty and splendid cooperation of my administrative associates, the productivity and accomplishments of the faculty and staff--all have been richly rewarding to me. I am grateful for the opportunity that has been mine to be a member of such a team and to have had a small hand in helping to create an environment in which such productive scholarship could develop and thrive.

Some Things Learned

In the thirty years I have spent in university administration, I have learned some things. Whether they have wide application I do not know. Everyone, I believe, is influenced to a considerable extent in his own thinking by his own experiences. He may perhaps therefore, draw conclusions sometimes that are not entirely valid or warranted. Possibly I do.

But among the things which, I think, I have learned are:

1. Universities, like all human organizations or institutions, are made up of men and women. They can be no better than the men and women of which they consist. Hence I am inclined to think that perhaps the most important administrative function any university has is the recruitment of staff and that upon how well it does this over the years, its ultimate success depends.

Some institutions leave the responsibility of recruitment largely or entirely to departments; some to committees of the faculty; some pretty much to provosts, deans, directors or other administrative officers.

Of one thing I am quite sure, this responsibility should never be placed in the hands of a single man, no matter who he is. There is too much danger of individual bias--personal likes and dislikes, friendships, emotions and other human traits, affecting his judgment.

Nor do I think recruitment can with safety, be left always to departments. Some departments may become smug and complacent, basking in the shadow of their own past greatness and dry rot sets in. Some professors may not relish the disturbing influence of competition. A young man in this university once asked, "How does the President know when a department needs rehabilitation?" To which one of my administrative colleagues replied, "When the stench gets so strong that even the President's nostrils cannot escape it."

And I wouldn't assign the task of recruitment exclusively to faculty committees, as some advocate and some administrators do, on the theory that faculties have some God-given wisdom and know better than anyone else who is most worthy of admission to membership in their company.

Personally, I like the system that has evolved here in California over the past thirty or forty years--a system of checks and balances and which involves the work and cooperation of committees, departments, administrative officers and anyone else for that matter who can help. I would not be completely frank with you, however, if I did not admit that some of my very good friends in other universities, themselves very prominent and very able university administrators, regard California's system of recruitment and promotion as intolerable--not to say

pernicious. I can only say that in my opinion it has worked well here--but again that may be a judgment based too much upon my own experience--an experience which, as I have already said, has been almost exclusively in this university.

2. Another point in recruitment which I think may well be kept in mind if we are really striving seriously to strengthen our university, is that we should aspire, even though we may not always succeed, to make each appointment a better one than the last. We should believe that no one is too good for our company and strive to find the best man available wherever he may be.

This procedure, of course, may sometimes conflict with another important principle, namely, that morale is built by promotions within the staff and good judgment must be exercised in its use. We should never overlook good material at home or assume always that better material is to be found elsewhere. We may sometimes underestimate the capacities of one of our associates with whom we have lived and worked and know well, and there certainly is some risk that we may overrate someone at a distance whom we do not know so well. Nevertheless, if a full and careful survey of all possible candidates has been made, one can then be more assured and hence more happy and content when one finds that "best available man" already in his own institution.

In recruitment, I suggest too, that you avoid tying your hands by the assumption that someone is not available. If you really want him, let him settle that matter by a discreet inquiry on your part. There may be personal or family reasons that make your proposal attractive, of which you may not be aware.

3. Also, I would say to administrators, make the most of what you have. At times most of us need encouragement and all of us welcome commendation and helpful criticism. A pat on the back may be all that is needed; at least it often helps. Some administrators complain about tenure, but I believe in it, strongly. Tenure may be irksome at times--especially when one has made a mistake or has inherited a mistake made by his predecessor, but in the long run its advantages far outweigh its disadvantages.

And I would say to staff members, make the most of the situation in which you find yourself at any time. Strive, of course, to improve it--not by labor union techniques, but by hard and conscientious work. If you can't improve it, there is always the possibility of leaving. I have often said, especially to young men, that the best kind of tenure I know results from making oneself so useful his institution cannot get on without him.

I would say to both administrators and staff members, try to discover your mistakes early so that the individual concerned may move on to a place where he fits in better and thus can be happier and more productive. It is much better to be in the lead of a procession that is moving slowly than to be continually struggling to keep up with one which is moving too fast for us. I have had the unpleasant task of having to advise a few young men to seek larger opportunities elsewhere for that very reason, but I am happy to say that in each case where my advice was taken, it resulted in good, both to the individual and to the university.

It is fortunate for all when this can be done while the individual is young and can readjust. We all know that young plants transplant more readily than old ones.

4. When you already have reasonably good leadership in any field, bet on youngsters. They will have had the most modern training and education, and it is easier to get rid of them if you do make a mistake, which you will do occasionally despite the best of care. And you will have them longer if you do make a ten-strike.

In conclusion, I repeat what you already have discovered, namely, that I have no very specific principles of university administration to propose. Successful university administration, I think, hinges largely upon common sense, tolerance, judgment of men and human nature, ability to recognize competence--even when clouded by idiosyncrasies or other human frailties (all men are not easy to live with--just ask your wife!). And above all an administrator should possess the ability to inspire confidence in his associates. No one should expect to gain and retain the confidence and loyalty of others merely by reason of the position he happens to occupy. He has to win it by sheer merit and by what he does. He cannot gain the confidence of others unless he can demonstrate his confidence in them. He must be able to develop team work and good personal relations in which each individual thinks of himself as an important member of the team and is not only willing but eager to carry always even more than his share of the load.

A university is a group of scholars, teachers and students, <u>all learners</u> and all dedicated to the proposition that the truth must always be sought; that the true scholar and the most effective teacher is continually seeking it and striving always to develop in his students a similar desire to seek the truth; that the university is society's best place for the testing of ideas--unpalatable at times to some segments of the public though they be; that while the right to teach the truth as one sees it must always be maintained; even more important is the right of students to learn--the right to challenge what someone else may say or believe is the truth--be he teacher or layman, if one's own reasoning indicates doubt.

The universities of our respective states are the people's most precious possessions. Upon what these institutions do in the education of succeeding generations more than upon any other thing, depends the welfare of society. That places upon us, teachers and administrators alike, in whose hands the welfare of our respective universities temporarily rests, a very grave responsibility. We may falter, we may stumble, we may make mistakes, but our universities go on forever--the better or the worse for our temporary stewardships.

These, then, gentlemen, are some of the things I have learned, some of the philosophies of university administration which I have developed over a considerable number of years. They are the result of my own experiences and observations. Whether they are the best that might have been developed from that experience I am somewhat doubtful. Whether they would be different had my experiences been different or whether they will work elsewhere, I do not know. I can only say that when I look about this campus and reflect upon the accomplishments of this faculty since I have known it, I believe I can discern here results for

good through the application of these philosophies. In all humility I commend them to you who are administrators and to you who some day will be, as worthy of your reflection.

And in even more humility I am grateful to those who have permitted me to be a member of this team.

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